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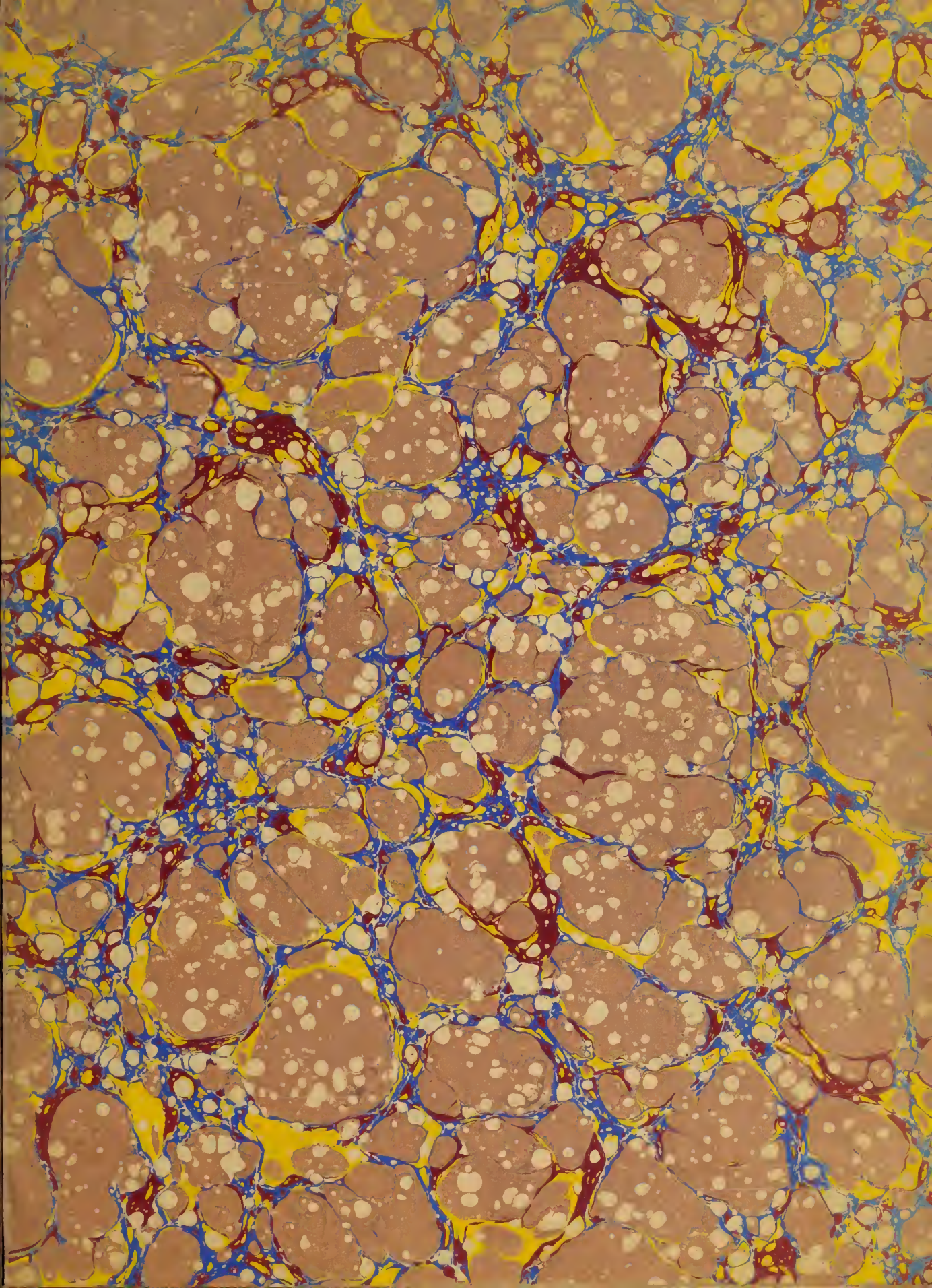

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The Cyphers Incubator Catalogue and Guide to Poultry Culture

Price, 10 Cents

Third Annual Catalogue of The Cyphers Incubator Co.

WAYLAND, N. Y.

1899

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THE CYPHERS INCUBATOR COMPANY.

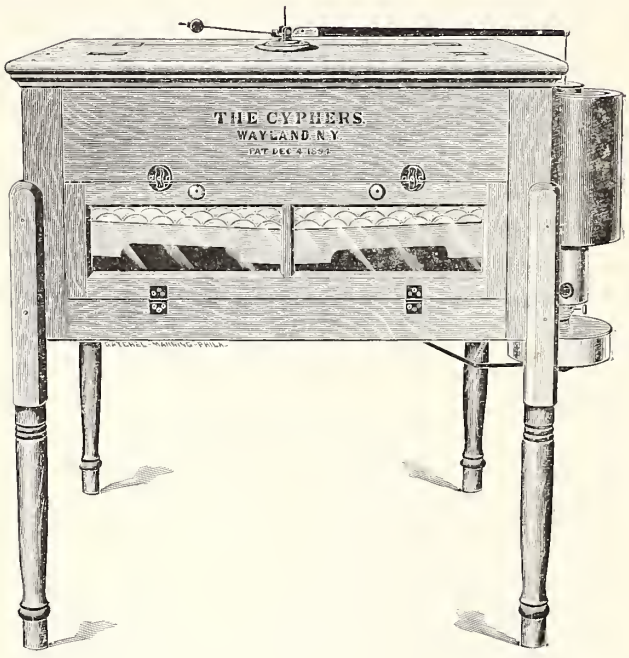
PRESS OF
EDWARD STERN & CO., INC.
PHILADELPHIA.

Very truly yours

Chas. A. Gyphers

Yours truly,

Frank S. Patchin


THE CYPHERS
WAYLAND N.Y.

THIRD ANNUAL CATALOGUE

OF THE

CYPHERS INCUBATOR COMPANY

IT will be perceptible to the most casual reader that any incubator that has built up in but two seasons a reputation such as the Cyphers now enjoys as a leader the world over, must have some points of merit over the old style machines which its competitors are manufacturing.

We will here endeavor to show in what way it excels; and further, knowing full well that many who have entered the field of poultry raising failed, we shall also point out why some met with disaster, how it could have been avoided, and why the few are succeeding. In other words, we shall try to show the hard business side of this rapidly growing industry, and instruct those who are about embarking in poultry raising how to avoid the shoals on which their less fortunate brothers wrecked. We shall give matter not only of value to the beginner, but also to the old and experienced poultry raiser.

We desire, in this connection, to thank our many friends who have favored us with their confidence in the past, tried our machines, learned their value, and have since contributed in no small degree to our rapidly growing business.

From those who have not used the Cyphers, we bespeak a careful perusal of the factors that govern the incubation of an egg, and how these factors are only partially controlled by other makes and completely by ours, giving the Cyphers added advantages over every other incubator on the market.

Those who have seen the 1898 model will note the improved heater and lamp hanger on the 1899 model, giving us a still better and more convenient hatcher.

THE CYPHERS INCUBATOR COMPANY.

POULTRY BREEDING.

The poultry industry has now grown to such proportions, aggregating upwards of $290,000,000, or the annual consumption of a little over $4 worth of poultry and eggs by every man, woman and child in the United States, that it may not be necessary to dwell on this side of the question. However, the figures given in a lecture to the "New York farmers," by Mr. H. W. Collingwood, may be of interest to some of our readers:

"I wish to call attention to the fact there are in this country to-day, in round numbers, 375,000,000 chickens, and 40,000,000 other fowls, such as ducks, geese and turkeys. During 1897 the hens laid 14,400,000,000 eggs. The export price at New York City averaged fifteen cents a dozen, which makes the value of the egg crop $165,000,000. Poultry sold as meat, as broilers, boilers and bakers, brought $125,000,000 more, making the total hen crop, at a very conservative rate, $290,000,000. You gentlemen are accustomed to deal with values that are concentrated, brought together into immense blocks, so that the value is at once noticeable. This great value of the hen crop is scattered broadcast. We deal with it chiefly from the individual side, and it is astonishing to realize how much it is in the aggregate. In order that these figures may be appreciated, I will call your attention to a few statistics:

Earnings of poultry	$290,000,000 00
Total of pensions	139,280,078 15
Total of school expenditures	178,215,556 00
Total interest of mortgages	76,728,077 00
Value of swine	186,529,745 00
Value of potato crop	78,984,001 00
Value of tobacco crop	35,574,220 00
Value of cotton crop	259,164,640 00
Value of oat crop	163,655,068 00
Value of wheat crop	237,938,998 00
Salaries of all school teachers	116,377,778 00
Value of all church property	679,630,139 00
Total military expenses	52,947,075 00
Value of all minerals	218,168,788 00
Value of hogs	186,529,745 00
Value of gold	46,610,000 00

Value of silver	$72,510,000 00
Value of wool	38,146,559 00
Value of sheep	68,167,725 00
Value of milch cows	263,955,545 00

"In one year the hens of the country will pay the net bonded debt of Greater New York and have enough left to buy all the gold and the silver mined during the year—that is, if they could borrow $10,000,000 from the ducks and geese. One year's earnings will buy all the minerals produced in a single year, and will pay, in addition, every cent of the interest on farm mortgages."

There are but two universal farm products that enjoy an ever-open market, that can be sold at a profit for cold cash at any season of the year, and in any year of the century—meat and grain. To-day, beef, pork and mutton, like grain, can be raised at the greatest profit in the Western States and Territories, where rich pasture land is counted rather by the square mile than by the acre, and the rich unsapped soil allows the kernel of grain to multiply itself the largest number of times. These industries are still carried on in some sections of the East at an ever-decreasing profit; but the poultry industry is equally profitable in all sections of this broad land where fowls can be raised within 300 miles of a thickly populated district. While there are sections where the prices rule lower than others, there are usually natural advantages that make up for them. Furthermore poultry raising can be carried on very profitably by many that are not in a position to venture into a business requiring their whole attention and a large capital to start.

That the market will never be overstocked with poultry or eggs, has been amply proved by the past. Ten years ago broilers brought 40 to 50 cents a pound. The past season the New York market still paid 45 cents, notwithstanding the fact that during that period upwards of 300,000 incubators have been sold. Such being the experience of the past ten years, during which period the successful poultry ventures have been greater than for all previous time, who needs to fear for the future.

It is a positive fact that the market is absolutely dry of first-class prime stock nine months out of the twelve. The hotels as well as private families, use tons of frozen stuff, not from choice, but because they are forced to, being unable to secure fresh stock at all seasons, for which they would be willing to pay higher prices.

To the vital question—How is it done? A breeder who raises from 4,000 to 5,000 chicks a year, remarked to us recently, "It is not the market, that always pays us a good profit; it is not the feed, that hardly counts, as it only costs us from 4 to 5 cents a pound to raise either broilers or roasters, and from 6 to 12 cents a dozen to produce eggs, according to the season of the year; what we desire to know is, *how to hatch and rear the largest percentage of eggs set and chicks hatched*"—and this catalogue tells you how to do it.

START RIGHT.

By starting right we do not mean that it is necessary to erect a $1,000 hen house, a $1,000 brooder house and spend another thousand on stock and fixings. Notwithstanding the large number of incubators in use and the thousands of dollars spent on poultry plants, it is still a fact that three-fourths of the poultry is raised broadcast by the farmers' wives. Such being the case, we write this for their special benefit, to help them in their laudable efforts to increase their income. The information is equally valuable to the clerk who lives in a suburban home, as we have known $2,000 to have been earned on four city lots, as in the case of H. G. Huey, of North Woodbury, N. J.

If practicable, buy one or more pens of pure-bred stock. This will give you a good foundation to work on. If you have not the necessary cash for that purpose, select out the best hens you have and buy a pure-bred cockerel to mate them with. Never buy cockerels and pullets from the same yard, and buy new unrelated male blood every year for your own flock, unless you have other blood on the farm. Inbreed stock gives weak-germed eggs, which, in turn, give poor hatches and weak chicks. Scientific feeding cannot overcome the tendency of unscientific breeding. In the production of eggs for broilers, we must pay extra attention to the breeders. The chief quality wanted is vigor and strength. The broiler and its digestive organs must be sound or it will not stand the strain. The forcing of the broiler is abnormal at the best, and it must have vigor or it will break down. It is possible, by careful selection and breeding, and by scientific feeding, to double the number of eggs which the average hen will lay, or to double the weight of broilers in a given time that may be hatched from her eggs.

Never buy mongrel stock, for no man is justified in raising mongrel poultry. It is the same with poultry as with horses, or cattle, or sheep, or hogs—the most money is to be made in producing thoroughbred stock. It takes no more house or yard room, no more feed, no more time

BIRD'S-EYE VIEW OF CYPHERS INCUBATOR COMPANY'S PLANT. D. L. & W. R. R. TRACK IN THE FOREGROUND. MR. CYPHERS' RESIDENCE AT THE LEFT. 300-FOOT BROODER HOUSE AT THE RIGHT.

or labor to raise one or ten hundred pure-blooded fowls than it does to raise an equal number of mongrels, but the value of the product in one case ranges from twice to several times as much as in the other, according to your skill as a breeder and the market you reach.

In this day of over-production what is wanted in many lines of effort is quality, not quantity alone. We have too much quantity and not enough quality. There is a premium in every market on quality, and that premium is nine-tenths profit. So we advise breeding pure-blooded fowls, and be sure that they have the size and vigor.

If a fowl is not forced for a broiler, but allowed to make a slow and steady growth on free range, the constitution is improved, and many of the effects of inbreeding are overcome; but foreign blood must be introduced yearly to maintain the standard of vigor. If anyone doubts the value of free range on growing stock, let him kill and dissect a chick forced for a broiler and one allowed free range for a breeder. The heart of the broiler will be found small and flabby, while that of the range chick will be double the weight, firm and strong, and able to do twice the work.

The value of free range in growing breeders was appreciated by A. C. Hawkins, when he told the farmers who took his chickens to raise that they could fence in their gardens, but they should not fence in his chickens.

WHAT BREED?

In broiler raising we want a fowl that in ten to twelve weeks will weigh from 1½ to 2 pounds; small comb; short neck; plump, round full-breasted body; yellow skin preferred; short, clean, yellow legs. Among the breeds most accessible to the majority of our readers, the White Wyandotte and Barred Plymouth Rock fill this bill. They are the two most popular fowls today, and are the most widely bred. But here let us state that the strain has much to do with it. We have seen specimens of both breeds that had lost all their good qualities. We have seen superior strains of one that would excel good strains of the other, and *vice versa;* and we have seen strains of other breeds that would equal either at their best, but we believe the average

quality of the Barred Rocks and White Wyandottes is higher than any other breed ; and being the most extensively raised, are the most accessible to the average beginner.

HOUSING THE LAYERS.

If but one or two pens of layers are kept the first season, quarters can be easily arranged for them in some out-building on the place, such as a southern corner of the barn, or woodshed. If there is no such place available, a lean-to can be made against some building or independently.

a warm shelter out of doors—a play-ground for the birds, as it were, where they can get fresh air and exercise during the stormy weather of the winter months, without being exposed to the cold rains and colder winds.

Having our layers properly housed, we need to feed them in such a manner that their digestive organs are kept in good working order, and the material necessary to health and egg production is supplied. First we need fresh water, as without a large percentage of liquid the vital functions cannot be carried on. It not only aids digestion

SECTION OF OUR CUTTING-UP ROOM.

It is often necessary for beginners to lay out the least possible amount of cash, and we give plans of houses to meet stringent demands. Some of the most successful breeders to-day kept their first flocks in a part of the barn or woodshed, and there are many more successful ones to come who will start in the same manner. Whatever is done, the roosting room should be made warm, and not too large. There should be a goodly-sized scratching shed, open to the south, to make

and assimilation, but it helps to wash out the impurities of the blood caused by the chemical changes going on in the animal economy. Dirty and stagnant water causes two-thirds of the disease among fowls.

After water comes grit, as without grit no species of bird that feeds on grain can digest its food properly, a large proportion passing through unassimilated.

Corn should form at least one-third of the food.

It is the most easily digested of all grains, and forms the best basis for egg production, where aided by proper accompaniments—green food and meat. Wheat has good feeding value, and should form another third of the grain ration. Green food, such as boiled clover, should form about

MACHINISTS' DEPARTMENT.

25 per cent. Clover is one of the most healthful stimulants that can be given fowls. Cabbage, turnips and potatoes can be fed as a change. Eight to 10 per cent. meat scrap should be given. Green bone, while being a good egg stimulant, contains a large percentage of fat in not as digestible a form as secured in corn; while lean meat, such as horse flesh, or pressed beef scrap gives the nitrogenous food that meat is designed to supply. Both green food and meat are necessary to perfect egg production, and eggs from confined stock not supplied with them are worthless to hatch. Yet, if either green food or meat is given in large quantities, the eggs will be plentiful, but large and watery, and will not hatch. Too much turnip is very bad, and too much cabbage also. They should be given moderately at the noon feed, which should consist of cracked corn or whole wheat scattered in their litter. Fine-cut clover should be boiled and mixed in a mash with wheat bran, corn meal and meat scrap, to be fed night and morning. Do not use clover meal, but cut the clover about ¼ inch long. One of its chief values is to give bulk and looseness to an otherwise soggy mash.

During cold weather care should be taken that the eggs are not chilled. Only the perfect eggs should be selected for incubating. Thin shelled or odd irregularly-shaped eggs should not be incubated. The very small and very large ones should also be discarded.

INCUBATION.

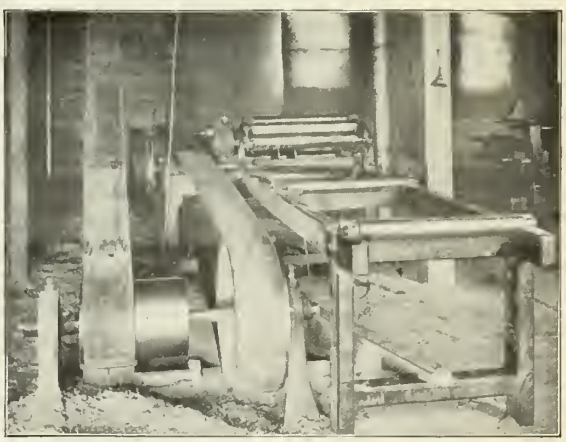
We have purchased our fowls and housed them in the best manner we can afford. We have been feeding for eggs, and as they are now laying we are ready for hatching. It is the dead of winter, and we will have no hens wanting to sit for two or three months yet. It is desirable to hatch now, though we are getting 40 cents a dozen for eggs, because for every two eggs we should market a nice plump broiler in February, March, April, May and June at 30 cents to 40 cents a pound, and for the balance of the year at from 18 cents to 30 cents, that costs us but 5 cents to 6 cents a pound to grow, making our eggs worth 16 cents each when they are selling at 12 cents a dozen, and 35 cents a piece at a time when they are selling at 40 cents a dozen. Such being the case, we wish to learn all that can be known about artificial incubation and brooding.

INCUBATION AND ITS NATURAL LAWS.

For the benefit of those who have not read the above work, we will here reprint the most interesting features of it, so as to give our customers a better idea of the requirements of artificial incubation.

HISTORY.

The art of artificially hatching hens' eggs has been known from the remotest ages. In Egypt,



SELF-FEED GANG RIP SAW. CAPACITY, 100,000 FEET PER DAY.

tradition attributes the invention to the ancient priests of the Temple of Isis.

It is impossible to determine at what period or to what nation the construction of the first eccaleobion should be credited. The first authentic account we find of the early methods is in "The

Voiage and Travaile of Sir John Maundeville, Kt.," in his description of the River Nile, Egypt, its geography, productions, etc., written some time previous to 1356. "Also at Cayre (Cairo), that I spake of before, sellen men, comounly men and women of other lawe, as we done here bestes

FOUR-SIDED PLAINER. CAPACITY 60,000 FEET TONGUE AND GROOVE CASING BOARDS PER DAY.

in the market. And there is a common hows in that cytee that is all fulle of smale furneys; and thidre bryngen wommen of the toun here eyren (eggs) of hennes, of gees, and of dokes, for to ben put in to the furneyses. And thei that kepen that hows covern hem with hete of hors doug, and outen henne, goos or doke or any other foul; and at the ende of three weeks or a monethe, thei comen agen and taken here chickens and norissche hem and bryngen hem forthe, so that alle the countre is fulle of hem. And so men don there bothe wyntre and somer." These hatching places at one time extended over Egypt, Damascus, Jerusalem and Samaria. They are now only found in Mausoura, in the village of Berma, situated in the Delta of the Nile. The Chinese have practiced the art for centuries, but do not seem to be able to duplicate the results when imported to other countries, on account of climatic conditions being different.

The Egyptians must have had a thorough knowledge of the details of their method, for we find those having ovens, or mamals, and making artificial hatching a business, giving sixty newly hatched chicks in exchange for 100 eggs.

The stories that reached France of the success of the Egyptians in this branch of rural economy created considerable interest at one time. One Florentine Duke imported an Egyptian director, and met with considerable success. In 1415 Charles VII became interested, as did also Francis I, at Montrichard, about 1540. Bonneman, a physician of Nauterre, 1777, seems to have been the first to establish hatching ovens whereby the heat was generated with fire and diffused by a circulation of hot water. Though the stories of his establishment are undoubtedly of lusty growth, the fact remains that he had chickens all the year round, and supplied the Imperial Court of France in all seasons. The disastrous events of 1814 were the ruin of his establishment.

To John Champion, Berwick-upon-Tweed, England, 1770, however, probably belongs the credit of first hatching eggs by the aid of fire. He used a room through which passed two heated flues, the eggs being placed on a large, round table in the centre. He claimed that the incubation was performed as well, and as many of the eggs hatched, as if they had been set upon by a hen. He says: "The two flue places do not open into the hatching room, but into one adjoining, where the keeper sits and the coal is kept. By this means the eggs are free from smoke and dust, which they might otherwise be greatly injured by. The two rooms have a door communication that the keeper may every now and then visit the eggs, and see if they are in the proper degree of heat."

OUR 60 HORSE-POWER ENGINE.

From this time on to 1846 little was accomplished, though Bucknell and others attempted the artificial process. James Canteto was more successful, and gave the subject considerable study. The theories that he put forward at that time, though based on no definite data, have been

used as a basis for the construction of the various incubators to the present time.

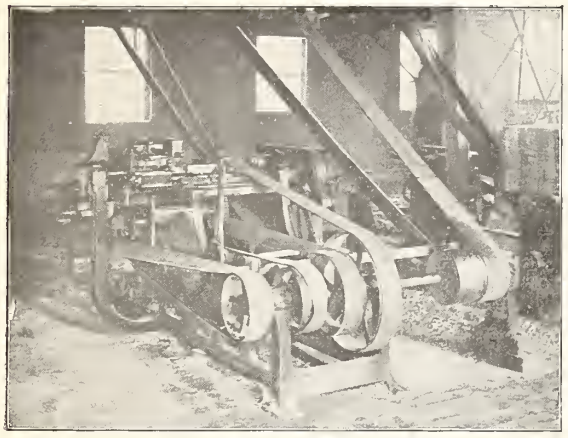
Messrs. Jacob and Henry Graves, of Reading and Boston, Mass., were among the pioneers of this line of invention in this country (1870), followed closely by H. J. Haight, of New York City, and Messrs. Woodward and Millet, of Charlestown, Mass., in 1871.

It is most remarkable that, though the various modifications of the incubator came thick and fast from 1875, none of the inventors have considered it of enough importance to investigate the old and formulate new principles based on reliable data, interpreted by the aid of the known laws of physics, a popular knowledge of which has increased rapidly during the last half century. There have been sufficient time and money expended in perfecting various machines for incubating purposes, but the workers in this line have been groping their way in the dark, and in consequence many of the contrivances which have encumbered the patent list have been based on no principle, justified by no proof, while some, even, are in direct opposition to the laws of nature. They were not familiar with nature's laws, and consequently could not interpret the observed facts of natural incubation, and therefore were not masters of the fundamental principles upon which the success of their invention depended. Upon a knowledge of these laws depends the whole question of right and wrong, of success or failure.

OUR BOILER ROOM. 100 HORSE-POWER BOILER.

We are confidently told by the enthusiastic poultry litterateur to go to Nature, that she never errs, etc. 'Tis true that nature does not err, but human nature is very apt to. We would gain little knowledge of the laws that govern the incubation of an egg from watching a sitting hen

for a lifetime, if we have no knowledge of the forces of nature at work, gathered from a close familiarity with the laws that govern analogous phenomena. If we know nothing of gold mining, or of the formations in which gold is found, or the methods for extracting it from the



FOUR SIDED STICKER. CAPACITY 60,000 FEET EGG-TRAY FRAMING PER DAY.

soil, we may dig in rich gold-bearing earth for months, and cart it off to fill in sunken lots.

There is a great difference between that knowledge which is purely intellectual and that which is called natural knowledge. "A clever man, shut up alone and allowed unlimited time, might reason out for himself all the truths of mathematics by proceeding from those simple notions of space and number of which he cannot divest himself without ceasing to think, but he could never tell by any effort of reasoning what would become of a lump of sugar if immersed in water, or what impression would be produced on the eye by mixing the colors yellow and blue." The late Prof. Cooke, in one of his popular lectures, says: "In practical science the student is taught to follow out a chain of probable evidence, with care and caution to eliminate all accidental phenomena, and supply by experiment and observation the missing links, until he reaches the final conclusion, an intellectual process which, though based wholly on probable evidence, may have all the force and certainty of a mathematical demonstration. Indeed, that highly valued scientific acumen and skill which enables the student to brush away the accidental circumstances by which the laws of nature are always concealed until the truth stands out in bold relief, is but a higher phase of the same talent which marks professional skill in all the higher walks of life. The physician who looks through the external symptoms of his patient to the real disease which lurks beneath; the lawyer who disentangles a mass of conflicting testimony and follows out the truth successfully to the end; the statesman who sees beneath the froth of political life the great fundamental principles which will inevitably rule the conduct of the State, and thus foresees and provides for the coming change; the general who discovers amid the confusion of the battle-field the weak point of his enemy's front, and the merchant, even, who can interpret the signs of the unsettled market, employ the same faculty, and in not a much lower degree, that discovered the law of gravitation, and which, since the days of Newton, has worked so successfully to unveil the mysteries of the material creation."

NATURAL INCUBATION.

In order to understand the requirements of artificial incubation, we shall need to first consider the observed facts in relation to the natural processes, by a comparison of which the general principles common to all may be deduced.

If left to herself a hen will prepare a shallow receptacle for the eggs, to aggregate them in a space that may be covered by the incubating body and keep in the warmth.

When a hen becomes broody after laying a clutch of eggs the plexus of the organ of incubation is developed, which consists of an arterial plexus ramifying beneath the integument of the

DOWLING INCUBATOR DOORS.

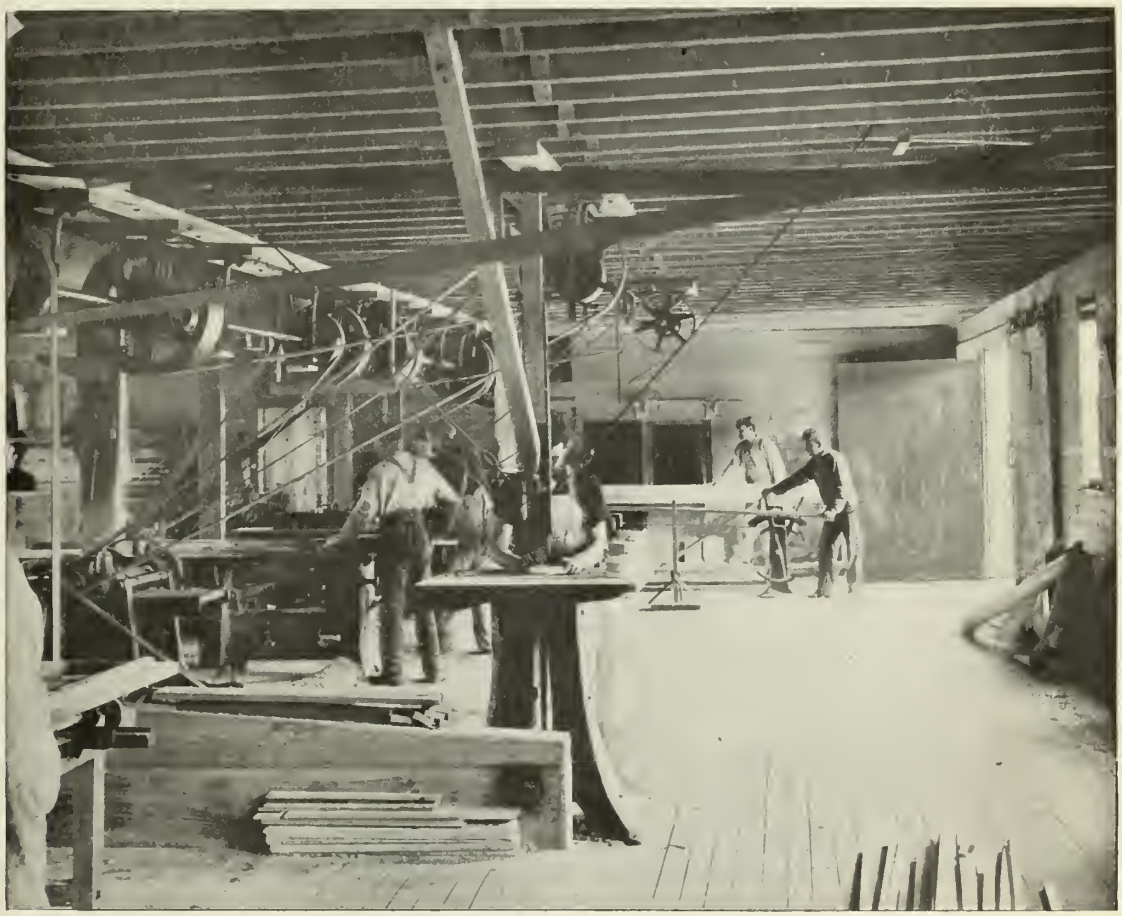
abdomen, and form, by their unions, a rich network of vessels which becomes truly extraordinary in the time of hatching. Thus the warm blood is brought to the surface which is opposite the eggs, bringing the latter to a temperature that approaches more nearly to that of the

blood of the fowl than they would otherwise be brought.

After this preparatory stage a hen sits on the eggs more or less constantly for about twenty days, from time to time moving them about in the nest, probably adjusting them to her own comfort.

As a rule, the larger number of a sitting of eggs will become arranged in a circle, with the broad ends forming the circumference. This seems to be due to the hen's turning or shifting her position on the eggs, and to the shape of the body of the hen and of the egg itself. During the later stages of incubation the broad end becomes very slightly elevated; which is due in part to the nest becoming more hollow, and to the bulk of the contents of the egg being situated in the small end, making that portion of it the heaviest.

In settling on the nest the hen makes a slight movement with the body from side to side which partially separates the eggs and forces them out in the feathers, only a comparatively small surface of each egg coming in contact with the incubating body. Over a greater part of that portion of the egg opposite the hen's body a layer of down and feathers intervenes, which also covers in the outer end and the remaining portion of the surface. Many times the feathers on the abdomen either fall or are plucked off during incubation, and the eggs are then brought into direct contact with the warm body.



SECTION CUTTING-UP ROOM.

The number of times the hen will leave her nest, as well as the period of remaining away from it, varies with different hens, and the state of the weather. In very warm weather the hen often rises in the nest and throws her feathers out to cool her body, thus partially uncovering the eggs. If the weather be excessively warm during the later stages of incubation the chicks will often be found dead in the shell.

For a few hours before first breaking the shell

the labored breathing of the chicks can be heard, with an occasional pip and chirp, and the eggs sweat. After exclusion the chicks at first sweat profusely, are highly sensitive to the slightest current of air, and huddle close to the hen's body for warmth.

LEFT SIDE CABINET ROOM.

In tropical climates the heat of the sun is supposed in some instances to be sufficient for incubation, as the ostrich is said to leave her eggs to be hatched by the heat of the sun's rays alone when she breeds in the neighborhood of the equator, but to sit upon them if inhabiting a more variable climate. Sir Richard Owen says, however, that "A steady, continuous temperature of about 100° F. is the requisite condition of successful incubation ; the heat of the sun alternating with the cold of night would hatch no bird's egg. The ostrich deposits about fifteen eggs in a hollow of the sand, the male bird incubates, and the young are excluded in from fifty to sixty days. (American Ostrich, male incubating, thirty-five days.)

The most striking exception to the rule of incubation is given by the Megapodes or mound-birds, whose range extends from the Philippines through the islands of the Indian Archipelago and Australasia. A huge mound of decaying vegetable matter is raised, the eggs are deposited vertically in a circle at a certain depth, and the chick is developed with the aid of the heat of fermentation. The egg is of large size, which affords a supply of material sufficing for an unusually advanced state of development of the chick at exclusion, whereby it has strength to force its way to the surface of the hatching mound, with wings and feathers sufficiently developed to enable it to take a flight to the nearest branch of an overshadowing tree.

There are upwards of thirty species of the family Megapodidæ, all of which have the peculiarity of burying their eggs in heaps of soil and decaying vegetable substances, trusting to the heat engendered by the decomposing mass for incubation. The mounds differ very much in their composition and form, according to location and species of bird. They vary in size from 15 feet to 175 feet in circumference, the latter usually being found in the densest thickets, and are doubtless the work of many ages, and of many birds in succession. In the smaller mounds the eggs are deposited so as to form a circle directly in the centre of the mound, at about 2 feet in depth, separated only by about 3 inches of earth. In the larger ones but a single egg is laid in each hole, at a depth of from 5 to 7 feet, and after the egg is deposited the earth is immediately thrown down lightly until the hole is filled up.

THE EMBRYONIC DEVELOPMENT OF THE CHICK.

It will be found essential to a comprehensive understanding of the Phenomenon of Incubation to have a general knowledge of the Embryonic Development of the Chick.

THE STRUCTURE OF THE EGG.

In a fresh egg the following structures are met with:—

The most external is the *shell*, composed of calcareous matter, the particles of which are deposited in a regular manner, designed to give strength and porosity.

STOCK-ROOM CONTAINING FINISHED TOPS AND SIDES FOR 2,000 INCUBATORS.

It consists of an outer thinner and an inner thicker layer, both of which are pierced by vertical canals, opening freely on both the exterior and interior surfaces. Through these canals the

interchange of gases between the interior and exterior air takes place, and the chemical process of respiration, though feeble at first, gradually increases in intensity, and is thus carried on during the whole period of incubation.

The appearance to the unaided eye of pores on the surface of the shell is due to the impressions of the villi of the formative membrane, the permeability of the shell by the atmosphere depending on a more minutely porous texture. The first effect of this porosity is the penetration of air between the layers of the lining membrane as the contents of the egg condense by cold and evaporation after it is laid. The air accumulates at the large end of the egg, between the two membranes, and increases in quantity as the other contents become condensed into the tissues of the chick, and contains a larger per cent. of oxygen than ordinary atmospheric air.

Fig. 1.

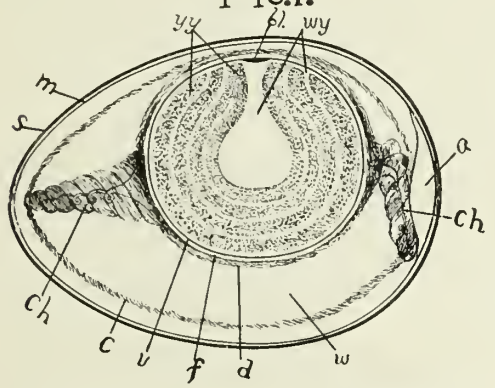


Fig. 1.—Diagrammatic section of an unincubated fowl's egg, *bl*, blastoderm, or germ spot; *wy*, white yolk, consisting of a central flask-shaped mass, and a number of layers concentrically arranged around it, the outer layer of white yolk lying immediately beneath the vitelline membrane, and connected with the central mass beneath the blastoderm; *yy*, yellow yolk; *v*, vitelline membrane; *f*, layer of more fluid albumen surrounding the yolk; *ch*, chalaze; *a*, air chamber between the two layers of the shell membrane; *m*, shell membranes, where they lie in contact over the greater portion of the egg; *s*, shell; *d*, denser albumen, which extends around the yolk outside of the internal layer of more fluid albumen; *c*, boundary between the outer and middle portions of the albumen.

The air space appears as the egg condenses on cooling, and gradually increases in size, whether the egg is incubated or not, as the albumen, which contains 78 per cent. of water in its composition, shrinks in bulk by evaporation.

Lining the shell is the *shell membrane*, which is double, there being an outer thicker and an inner thinner one. Over the greater part of the egg the two layers of the shell membrane remain permanently in contact (*m*); but at the broad end they tend to separate, and thus to develop between them a space into which air accumulates (*a*).

Beneath the shell membrane is the *white* of the egg, consisting of alternate layers of denser and more fluid *albumen*, the average composition of which may be taken as 20·40 per cent. proteid matter; 1·60 per cent. saline matter, chiefly sodic and potassic chlorides, with phosphates and sulphates; and 78·00 per cent. water.

In a hardened egg a spiral arrangement of the white may be observed, and it is possible to tear off thin layers in a spiral direction from left to right from the broad to the narrow end of the egg.

Two twisted cords, termed the *Chalaze* (*ch*), composed of coiled membraneous layers of dense albumen, run from the two extremities of the egg to the opposite portions of the yolk. Their inner extremities expand and merge into the layer of denser albumen (*d*) surrounding the fluid layer (*f*) next the yolk. The outer extremities are free, and do not quite reach the outer layer of the white. The function of the chalaze is to keep the yolk more steady in the albumen, and to moderate the effects of any violent movement or rotation of the egg. The interior of each chalaze presents the appearance of a succession of opaque white knots.

The yolk is enclosed in the *vitelline membrane* (*v*), a transparent and almost structureless membrane, devoid of pores. It is somewhat elastic, and easily thrown into creases and wrinkles.

On the upper surface of the yolk, and immediately under the vitelline membrane will be seen a little semi-opaque spot about one-eighth of an inch in diameter. This is the *blastoderm* or *germ-spot* (*bl*).

The blastoderm of a fertile egg will show an outer white rim, and within that a circular transparent area, in the centre of which, again, there is an opacity, sometimes uniform, and sometimes dotted. In an unfertile egg this white disc is simply marked with a number of irregular clear spaces, there being no proper division into a transparent centre and an opaque rim. This spot in the unfertile egg has sometimes been looked upon as a scar left where the yolk broke from its cell or capsule.

During the descent of the egg along the oviduct of the fowl, where it is exposed to a temperature of 110 degrees or more, the blastoderm undergoes important changes. When the egg is laid and becomes cold, the changes all but entirely cease, and the blastoderm remains inactive until, under the influence of the higher temperature of natural or artificial incubation, the vital activities of the germ are brought back into play, and the arrested changes go on again. The condition

of the blastoderm at the time when the egg is laid is not exactly the same in all eggs, though the differences of course are slight. In warm weather changes of the same kind as those caused by actual incubation may take place, to a certain extent, in the interval between laying and incubation.

The blastoderm is always found to be uppermost, whatever may be the position of the egg, provided there is no restraint to the rotation of the yolk. The explanation of this is to be sought for in the lesser specific gravity of that portion of the yolk which is in the neighborhood of the blastoderm. Though to the naked eye the yolk appears tolerably uniform throughout, a section of the yolk of a hardened egg will show that it is not perfectly uniform, but that there is a portion of it having the form of a flask (*wy*) with a funnel-shaped neck and a number of layers concentrically arranged around it; which, when the egg is boiled, does not become so solid as the rest of the yolk, but remains more or less fluid. The expanded neck of this flash-shaped space is situated immediately underneath, where it forms a bed on which the blastoderm (*bl*) rests; while its bulbous enlargement is about the middle of the yolk. This is known as the *white yolk* (*wy*), while the great mass of the yolk is composed of what is known as the *yellow yolk* (*yy*).

The yolk as a whole is of a lesser specific gravity than the albumen, in which it is immersed, while the pressure of the up-floated germ against the shell-wall is moderated by the weight of the denser albumen forming the chalaze.

The attachments of the chalaze being a little below the axis of the yolk, it adds its weight to the lower half, and thus helps to make the germinal half the lightest and uppermost. Under ordinary circumstances, rotation of the egg takes place on its long axis, and if a fresh egg be turned round, the blastoderm will keep its position upwards for one turn or a little more, and then, by the twisting of the chalaze, the yolk is carried completely round, and balances itself again with the blastoderm uppermost in its new position. These modifications of the oviparous egg, so delicately wrought, so wondrously endowed, in anticipatory relation to the needs and conditions of incubation, are scarcely conceivable.

THE BLASTODERMIC EXPANSION.

In the fertile blastoderm, as above noted, the naked eye can distinguish an opaque rim of some breadth surrounding a more transparent central area, in the middle of which again is a white spot of variable appearance. The opaque rim is the commencement of what is termed the *area opaca;* the central transparent portion is in the same way the beginning of the *area pellucida.*

The blastoderm, which at first lies with its margin resting on the circular wall of flask-shaped white yolk, spreads out, as a thin circular sheet, over the yolk, immediately under the vitelline membrane. Increasing uniformly at all points of its circumference, the blastodermic expansion covers more and more of the yolk, and at last reaching its opposite pole, completely envelops it. Thus the whole yolk, instead of being enclosed as formerly by the vitelline membrane alone, comes to be also enclosed in a bag formed by the blastoderm, termed the *germinal membrane.* It is not, however, until quite a late period that the complete closing in at the opposite pole takes place, so that the extension of the blastoderm, or germinal membrane, must be considered as going on during nearly the whole period of incubation. Both the area opaca and the area pellucida share in this enlargement, but the area opaca (*Fig. 2, ao*) increases much more rapidly than the area pellucida (*ap*), and plays the principal part in encompassing the yolk.

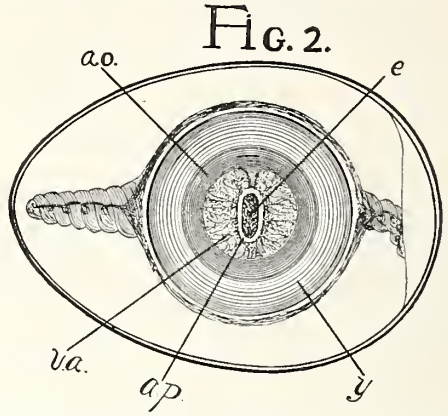


FIG. 2.—A fowl's egg after about forty-eight hours incubation, viewed from above, the upper portion of the shell being removed: *y*, yolk; *ao*, area opaca, or that portion of the blastoderm which extends over the yolk as the germinal membrane; *va*, the vascular area of the area opaca, the growth of which is somewhat slower than the germinal membrane; *ap*, area pellucida, in the centre of which lies the embryo, *e*.

The circular transparent area, or that part of the area opaca which is nearest the area pellucida, becomes the seat of peculiar changes, which result in the formation of blood-vessels. Hence this part of the area opaca is called the *vascular area* (*va*). The embryo (*e*) itself grows out from the most central portion of the blastoderm, or the central portion of the area pellucida (*ap*). The head appears first, and several hours later the

tail, when the embryo has the appearance of being encased in a small sac and lying in a depression of the yolk-sac, with which it is connected. As incubation proceeds, the embryo gets larger at the expense of the yolk, which is gradually assimilated by nutritive processes.

Within a day or two of the hatching of the chick, at a time when the yolk-sac is still of some size, or at least has not yet dwindled away altogether, and the development of the embryo is nearly complete, the yolk-sac is slipped into the body of the embryo, so that ultimately the embryo with its coverings alone remain.

The general shape of the embryo is due to the direction and slope of the several outgrowths which share in its formation. In addition to this, the tubular sac of the embryo, while everywhere gradually acquiring thicker and thicker walls, undergoes at various points, through local activities of growth in the form of thickenings, ridges, buds or other processes, many modifications of the original outline conferred upon it. Thus, bud-like processes start out from the trunk to form the rudiments of the limbs, and similar thickenings and ridges give rise to the jaws and other parts of the face. By the unequal development of these outgrowths the body of the chick is gradually moulded into its proper outward shape. At the same time other growths take place within the body walls of the embryo, which result in the formation of the heart, liver, lungs, etc.

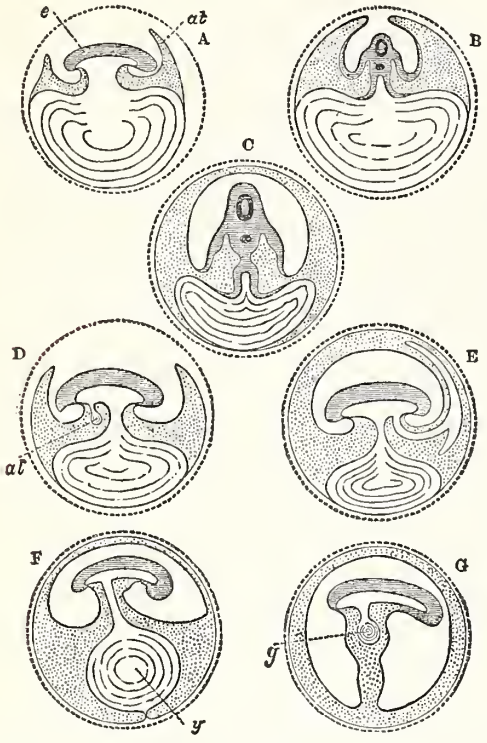
THE AMNION.

Very closely connected with the appearance of the head of the embryo is the formation of the *amnion*.

The amnion is developed in the following way: There first appears, a little way in front of the head, a fold or thin outgrowth running around in front of it (*af*). As it increases in height it is gradually drawn backwards over the developing head of the embryo (*e*). The fold thus covering the head is in due time accompanied by similar folds at some little distance behind the tail, and at some little distance from the sides (*B*). In this way the embryo becomes surrounded by a

SECTION LIGHT MACHINERY ROOM. POWER SAND PAPERING MACHINE IN FOREGROUND, WHICH DOES TEN MEN'S WORK SMOOTHING OFF.

series of folds of thin membrane, which form a continuous wall all around it. All are drawn gradually over the body of the embryo, and at last meet and completely coalesce (*C*), all trace of their junction being removed. Beneath these united folds there is therefore a concavity or sac within which the embryo lies.



Diagrams Illustrating the Development of the Amnion and Allantois.

Fig. 3.—In *A* the embryo (*e*) is seen lying in a depression on the yolk-sac, the folds of the amnion are rising up at either end of the embryo, the fold in front of the head (*at*) being the larger. In *B* the amniotic folds nearly meet, and in *C* they have entirely coalesced. In *D*, which is a little later stage than *A*, the allantois (*al*) is seen budding out from the intestine. In *E*, which is a stage corresponding with *C*, the allantois is seen extending round the embryo. In *F*, the yolk-sac (*y*) is reduced in size, and in *G* it is being withdrawn into the body of the embryo. The allantois in *F* and *G* is omitted for the sake of simplicity. These diagrams only very roughly indicate the relations of the parts.

When the several folds meet and coalesce above the embryo, they unite in such a way that all their inner surface goes to form a continuous inner membrane or sac, and all their outer surface a similar continuous outer membrane or sac. The inner membrane thus built up forms a complete closed sac around the body of the embryo, and is called the *amniotic sac*, or *Amnion proper* (*Fig. 5*, *am*), and the fluid which it afterwards contains is called the *amniotic fluid*, or *liquor amnii*. The outer sac over the embryo lies immediately beneath the shell membrane, where it forms the outermost of the embryonic appendages, or *chorion*.

If the mode of origin of these two sacs, the inner or true amnion, and the outer or false amnion, and their relations to the embryo be borne in mind, the reader will have no difficulty in understanding the course taken in the growth of a very important organ, the *Allantois*.

THE ALLANTOIS.

The allantois is fundamentally an appendage of the alimentary canal, and is thrown out at the hinder end of the embryo (*D*, *al*). It very rapidly pushes its way, by the development of a long tube, into, and fills the space developed between the true and false amniotic sacs, and with the latter it extends over the yolk and albumen (*Fig. 3*, *E*, and *Fig. 5*, *al*), separated from the shell membranes by nothing more than the thin false amnion ; and in this position it performs its function as a respiratory organ, or lungs.

FIRST DAY.

During the first twelve hours of incubation the blastoderm when viewed from above is found to have increased greatly in size. The central white spot, or pellucid area, which at the best is but obscurely marked in the unincubated egg becomes oval in outline, and very distinct, and contrasts strongly with the outer opaque rim, which has been still more increased, both in distinctness and size.

During the latter part of the first day is seen the first definite appearance of the head, and the first trace of the amnion appears in front of it. The vascular area also begins to be distinguished from the rest of the blastoderm.

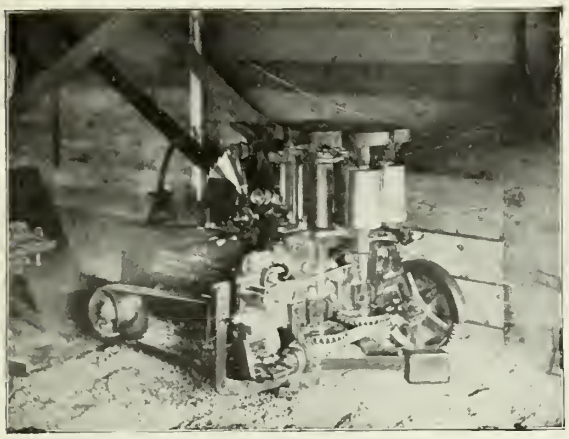
SECOND DAY.

At the beginning of the second day the head alone projected above the rest of the germ, the remainder of the embryo being simply a part of a flat blastoderm. At about the twenty-sixth hour the tail makes its appearance, being elevated above the level of the blastoderm in the same way that the head was elevated.

The amnion, especially the anterior or head-fold, advances in growth very rapidly during the second day, and at its close completely covers the head and neck of the embryo. The tail and side folds of the amnion, though still progressing, lag considerably behind the head-fold.

The first rudiment of the heart appears about the twenty-seventh hour, and is of a tubular

character, being formed by a longitudinal fold of the vascular layer. For some time it is undivided, being simply a long tube extending through nearly the whole length of the embryo. Although the development has proceeded thus far at about the thirty-fifth hour, no motion is



RESAW. CAPACITY 60,000 FEET TRAY FRAMES PER DAY.

seen in the heart or vessels until the thirty-eighth or fortieth hour.

When the heart first begins to pulsate it contains only colorless fluid mixed with a few globules. A movement of the dark blood in the circumference of the vascular area is at the same time perceived, but it is independent of the constrictions of the heart, and it is not until a subsequent period that a communication is established between the heart and the distant vessels, and the dark fluid contained in them arrives at the central cavity and is propelled by its pulsations. The formation of fluid goes on in every part of the body, and, when formed, it is put in motion by some unknown cause that impels it into the proper direction, until at length it reaches the central formation of fluid, around which is developed a tubular canal afterwards to be modified and changed into a heart. The first movements of the blood are towards the heart, and consequently the first vesicles formed are veins.

The blood-vessels which are first observed in the body of the embryo as well as in the vascular area appear formed in insulated points, which gradually coalesce so as to form tubes. No difference is at first observed between the characters of the arteries and those of the veins, and they are only to be distinguished by the direction of the currents of blood circulating through them. Subsequently, however, (about the fourth or fifth day of incubation), the coats of the arteries begin to appear thicker than those of the veins, and the distinction between them soon becomes evident.

Between the fortieth and fiftieth hours a separation of the heart in parts may be observed, which is effected by a constriction around the middle of the tube and the dilation of the posterior into a ventricular cavity.

THIRD DAY.

Between the fiftieth and sixtieth hours the circulation of blood in the vascular area becomes more vigorous; the tube of the heart becomes more and more bent together until it is doubled, so that this organ now becomes much shorter relatively to the dimensions of the body, and is more confined to the portion of the trunk to which it is subsequently restricted.

The blood-vessels become during the latter part of the second day connected so as to form a complete system, through which a definite circulation of blood is for the first time (consequently some little while after the commencement of the heart's pulsations) carried on.

Nutritive matter is transmitted to the blood by the under surface of the vascular area, and by the blood conveyed to all regions of the body of the embryo, the yolk in contact with it losing its coagulability. As the yolk is absorbed, it is in turn replenished at the expense of the white. The absorption, once begun, goes on so actively that by the end of the third day the decrease of the white is very striking.

RIGHT SIDE CABINET ROOM.

The blastoderm is now spread over about half the yolk, the extreme margin of the germinal membrane reaching about half way towards the pole of the yolk opposite to the embryo. The vascular area, although still increasing in size, is much smaller than the outer opaque area, being

in average sized eggs about as large as a quarter. Still smaller than the vascular area is the pellucid area, in the centre of which lies the rapidly growing embryo.

During the third day the vascular area is not only a means for providing the embryo with nourishment from the yolk, but also insomuch as by the diminution of the white it is brought close under the shell, and, therefore, fully exposed to the influence of the atmosphere, serves as the chief organ of respiration.

The embryo is almost completely covered by the amnion. At the close of the day the several amniotic folds will have met along a line over the back of the embryo. Their complete coalescence and the obliteration of their line of junction will, however, not take place until the following day.

During the third day a most remarkable change takes place in the position of the embryo. Up to this time it has been lying symmetrically upon the yolk with the part which will be its mouth directed downwards. (If an egg be placed with its broad end to the right of the observer, the head of the embryo will in nearly all cases be found pointing away from him. Duval found 163 out of 166 examined, in this position.) It now turns around so as to lie on its left side. This remarkable change of its position is almost invariably completed on the third day. Coincidently with the change of position the whole embryo begins to be curved on itself. This curvature of the body becomes still more marked on the fourth day.

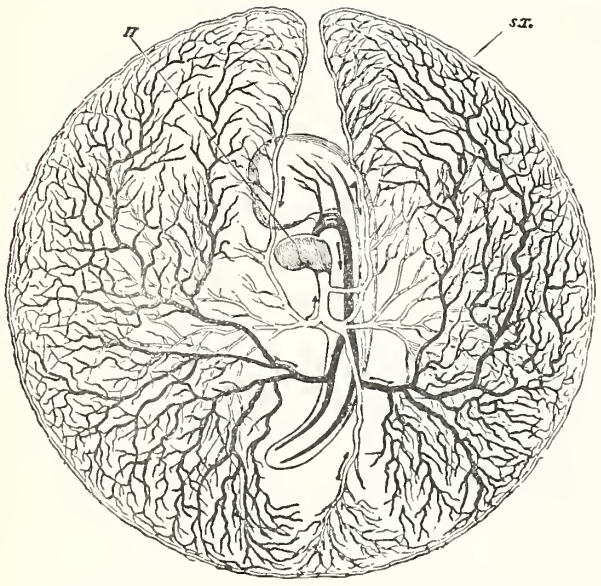


FIG. 4.—Diagram of the circulation of the yolk-sac (vascular area), at the end of the third day of incubation. The veins are marked in outline, and the arteries are black. The whole blastoderm has been removed from the egg, and is supposed to be viewed from below, hence the apparent reversal of the sides. *H* is the heart, and *S T* sinus terminalis—the vein which brings the blood back to the heart.

FOURTH DAY.

On opening an egg in the middle or towards the end of the fourth day a number of points in which progress has been made since the third day are at once apparent. In the first place, the growth of the embryo has been very rapid, so that its size is very much greater than on the previous day. In the second place, the white of the egg is still further diminished, the embryo lying almost in immediate contact with the shell membrane. The germinal membrane embraces more than half the yolk, and the vascular area is about as large as a half-dollar. Corresponding to the increased size of the embryo there is a great increase in the activity of the blood circulating in the vascular area.

The amnion becomes increasingly conspicuous. It is now seen as a distinct covering, obscuring to a certain extent the view of the body of the chick beneath, and all trace of the junction of its folds are by this time lost. As yet there is very little fluid in the amniotic sac proper, so that the dry amnion lies close upon the embryo.

The tail, which commences to be noticeable during the third day, is during this day increased very much, and the somewhat curved tail forms quite a conspicuous feature of the embryo.

The general curvature of the body is also increasing, and as the result of these various flexures the embryo has very much the appearance of being curved upon itself.

The distinct appearance of the limbs must be reckoned as one of the most important events of the fourth day.

The allantois becomes for the first time conspicuous on this day, though the first appearance of the rudiments of it appear on the third. Soon after its appearance the allantois may be easily recognized as a pear-shaped vesicle, connected with the under surface of the alimentary canal by a long hollow stalk. It does not, during the third day, project beyond the body of the chick, but on the fourth day begins to pass out on its way to that space between the external and internal folds of the amnion. In this space it spreads out and eventually encloses the whole contents of the egg beneath the shell membrane (*Fig. 6, a*). On the first half of the day it is very small, and its growth is not very rapid. In the latter half of the day its growth becomes more

rapid, and it forms a very conspicuous object in a chick of that date. At the same time its blood-vessels become important.

FIFTH DAY TO END OF INCUBATION.

On opening an egg about the middle of the fifth day the observer's attention is not arrested by any new features, but he notices that the progress of development, which was so rapid during the latter half of the fourth day, is being continued with undiminished vigor. The allantois, which on the fourth day began to project from beneath the embryo, has grown very rapidly, and now stretches far over the right side of the embryo (which it will be remembered is lying on its left side) in the cavity between the two amniotic folds. It is very vascular, and already serves as the chief organ of respiration.

The germinal membrane has spread over the whole of the yolk sac, and the yolk is thus completely enclosed in a bag whose walls, however, are excessively delicate and easily torn. The vascular area extends over about two-thirds of the yolk. The embryo remains excessively curved, so much so, indeed, that the head and tail are nearly in contact.

The amnion at its complete closure on the fourth day very closely invested the body of the chick, the true cavity of the amnion was then, therefore, very small. On the fifth day fluid begins to collect in the cavity, and raises the membrane of the amnion to some distance from the embryo. The cavity becomes still larger by the sixth day, and on the seventh day it is of very considerable dimensions, the fluid increasing in it.

SECTION METAL WORKING ROOM

By the seventh day very obvious movements begin to appear in the amnion ; its slow vermicular contractions creep rhythmically over it. The amnion, in fact, begins to pulsate slowly and rhythmically, and by its pulsation the embryo is rocked to and fro in the egg. Similar movements are also seen in the allantois at a considerably later period.

The growth of the allantois has been very rapid, and it forms a flattened bag covering the right side of the embryo, and rapidly spreading

out in the direction between the primitive folds of the amnion, that is between the amnion proper and the false amnion, or chorion. It is filled with fluid, so that in spite of its flattened form its opposite walls are distinctly separated from each other.

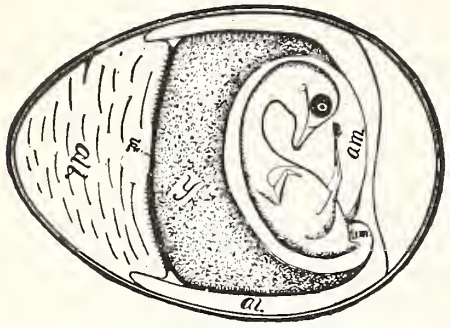


FIG. 5.—A diagrammatic section through the fowl s egg about eleven days incubated. *Al*, cavity of the allautois; *alb*, albumen; *am*, cavity of the amnion; *um*, umbilicus, or sma'l hollow tube connecting the embryo with the amnion, yolk-sac and allantois. The outer covering of the umbilicus is formed by the amnion, and is continuous with the body wall of the embryo. Through this tube passes that of the allantois, and also that of the yolk-sac. By means of the latter the walls of the alimentary canal are continuous with the membrane covering the yolk-sac, and the interior of the canal is continuous with the inside of the yolk-sac. At a comparatively early period the canal of this stalk becomes obliterated, so that the material of the yolk can no longer pass directly into the alimentary cavity, but has to find its way into the body of the chick by absorption through the blood-vessels.

When in the last days of incubation the greatly diminished yolk-sac with its germinal investment is withdrawn into the rapidly enlarging abdominal cavity of the embryo, the walls of the abdomen close in and unite without any regard to the amnion and the shriveled, emptied allantoic investment, which are cast off as no longer of any use.

The vascular area has become still further extended than on the previous day, but with a corresponding loss in the definite character of its blood-vessels. The sinus terminalis (thin red line around the extreme margin of the vascular area, and nearly completely encircling it) has, indeed, by the end of the seventh day lost all of its previous distinctness, and the vessels which brought back the blood from it to the heart are no longer to be seen. The yolk is not so fluid as on the sixth day, though it continues to absorb the white of the egg, which is diminishing rapidly. The liquid thus absorbed by the yolk from the albumen serves for the formation of the amniotic and allantoic fluids.

During the eighth, ninth and tenth days the amnion does not undergo any very important changes. Its cavity is still filled with fluid, and on the eighth day its pulsations are at their height, henceforward diminishing in intensity.

The allantois now spreads out over the greater part of the yolk-sac as a flattened bag filled with fluid, and serves as the chief organ of respiration. Hence it is very vascular, the vessels on the right side of the bag, which is turned to the chorion and shell, being especially large and numerous.

The yolk now begins to diminish rapidly in bulk. The yolk-sac becomes flaccid, and, on the eleventh day, is thrown into a series of internal folds abundantly supplied with blood-vessels. By this means the surface of absorption is largely increased, and the yolk is more and more rapidly taken up by the blood-vessels, and in a partially assimilated condition transferred to the body of the embryo.

By the eleventh day the abdominal walls, though still looser and less formed than the walls of the chest, may be said to be definitely established, and the loops of intestine, which have hitherto been hanging down, are drawn up into the abdomen. The body of the embryo is therefore completed, but it still remains connected with its various appendages by a narrow umbilicus (*Fig. 5, um*) in which run the stalk of the allantois and the solid cord suspending the yolk-sac. The allantois still growing rapidly, it completely surrounds the whole contents of the egg, except at the poll opposite to the embryo, where for some little time a small portion of albumen remains unenclosed; at this spot the diminished white of the egg adheres as a dense viscid plug.

The allantois lies over the embryo, close under the shell, being separated from the shell membrane by nothing more than a thin membrane formed out of the outer primitive fold of the amnion and the remains of the vitelline membrane. With this membrane the allantois partially coalesces, and in opening an egg at the latter stage of incubation, unless care be taken,

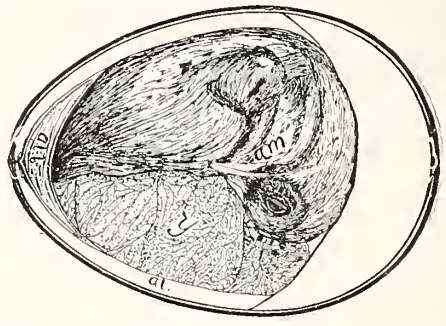


FIG. 6.—A diagrammatic section through a fowl's egg about sixteen days incubated; *al*, cavity of the allantois. The allantois now completely envelops the embryonic and yolk-sacs, and the remaining portion of albumen, *alb*. The amnion, *am*, is loosing fluid, and very closely envelops the embryo, while the yolk, *y*, is seen folded over it. The allantois becomes thinner and thinner as incubation progresses, so that at the last its two walls lie in direct contact, the fluid and cavity entirely disappearing.

the allantois is in danger of being torn in the removal of the shell membrane.

On about the sixteenth day the allantois is carried right over the pole of the yolk opposite the embryo, and is thus completed.

Deposits of urates now become abundant in

LEFT VARNISH ROOM.

the allantoic fluid. The loose and flaccid walls of the abdomen enclose the space which the empty intestines are far from filling, and on the nineteenth day the yolk-sac, diminished greatly in bulk, is withdrawn through the umbilicus into the abdominal cavity, which it largely distends. Outside the embryo there remains nothing now but the highly vascular allantois and the practically fluidless amnion.

By the sixth or seventh day the flexure of the body has become less marked, so that the head does not lie so near to the tail as on the previous days, and at the same time a more distinct neck makes its appearance. Though the head is still disproportionately large, its growth ceases to be greater than that of the body.

So early as the ninth or tenth day the sacs containing the feathers begin to protrude from the surface of the back as papillæ, especially prominent at first along the middle line of the back, from the neck to the rump and over the thighs, the sacs of the tail feathers being very conspicuous. On the thirteenth day these sacs, generally distributed over the body, and acquiring a length of a quarter of an inch or more, appear to the naked eye as feathers, the thin walls of the sacs allowing their contents, now colored, according to the breed of the bird, to shine through. They are still, however, closed sacs, and, indeed, remain such even on the nineteenth day, when many of them are of a considerable length.

On the eighth day a chalky-looking patch is observable on the top of the nose. This, by the twelfth day, has become developed into a horny, but still soft, beak.

On the thirteenth day nails are visible at the extremities, and scales on the remaining portions of the toes. These on the sixteenth day become harder and more horny, as does also the beak.

By the thirteenth day the cartilaginous skeleton is completed, and the various muscles of the body can be made out with tolerable clearness.

Ossification begins on the eighth or ninth day. As early as the sixth day movements may be seen in the limbs of the embryo upon opening the egg. We may conclude from this fact that spontaneous movements occur from time to time in the unopened egg. They cannot, however, be of any great extent until the fourteenth day, for, up to this time, the embryo retains the position in which it is formed, viz., that with its body at right angles to the long axis of the egg.

On the fourteenth day a definite change of position takes place: the chick moves so as to lie lengthwise in the egg, with its head opposite the chorion and shell membrane where they form the inner wall of the rapidly increasing air-chamber at the broad end.

By the eighteenth day the fluid in the amniotic sac, in which the embryo lies, has entirely disappeared, and the chick is breathing the air which it contains. The pulmonary circulation, which has been gradually developing since the third

RIGHT VARNISH ROOM.

day, increases in activity, and the circulation of blood in the allantois correspondingly diminishes.

By the twentieth day the fluid in the allantois has entirely disappeared, and the circulation of blood in the allantoic vesicles is quite sluggish. The chick now thrusts its beak through its cov-

erings, and breathes the outer air. At this time the blood entirely ceases to flow through the umbilical arteries into the allantois, and the pulmonary respiration now becomes the sole means of its aeration. The allantois therefore dries up, and the umbilicus becomes completely closed. In from

STOCK ROOM CONTAINING 1,000 FINISHED MACHINES.

six to ten hours from the time of first breathing the outer air, the chick, breaking the shell around the broad end of the egg with rapid blows of its beak, casts off the dry remains of the amnion and allantois, and quits its primitive home.

HEAT.

In all living beings, the taking in of food stuffs into the body, its conversion into a nutritious fluid, the blood, the elements of which supply the materials for the growth and renovation of the flesh, muscle, etc., and thus maintain their vital properties; and the excretion, or throwing off of the particles unfit for these purposes, constitute the sum total of the vital acts by which the life of the individual is immediately supported.

All vital action, however, requires a certain amount of heat for its due performance, and can only continue within a particular range of temperature, between the limits of which it is excited by the additional application of the stimulus, and depressed by its abstraction.

Thus it is seen that, for the normal exercise of the animal powers a steady temperature is necessary, and this is obtained by endowing the body itself with the means of generating warmth, and of resisting the violent action of external heat by refrigerating processes. By this means animals of the higher organization are rendered capable of enduring vicissitudes of temperature which would be fatal to many less perfect species, but the heat of its own body, which is that required for the continuance of its functions, varies extremely little.

Hence it is seen that the degree of external heat or cold cannot always be taken as an indication of that which is compatible with the performance of the actions of life, since if a warm-blooded animal in a temperate atmosphere is deprived of its power of generating heat it will speedily become incapable of continued existence, even at a degree of external heat which is fully sufficient for the energetic life of other organisms which are entirely dependent upon it.

ANIMAL TEMPERATURE.

Different species of animals exhibit great variations in the limitations of temperature which they require, and in their power of adaptation to extreme conditions. The temperature of the human body is usually stated at $98\frac{2}{5}°$, from the height of thermometers placed in the mouth, armpits, etc., but that of the stomach is generally 100°, and that of the blood from $100\frac{1}{2}°$ to $101\frac{1}{2}°$.

The temperature of birds is somewhat higher than that of mammals, being from 100° to $111\frac{1}{4}°$. The first is that of the gull and the last that of the swallow. The temperature of the common fowl is 110° (thermometer placed in the rectum), a chick a week old, taken from under a hen in the morning, will only have a temperature of about 106°, while the temperature of a half-grown cock or duck often reaches 111°.

CRATING ROOM.

GENERATION OF ANIMAL HEAT.

Animal or vital heat is generated by means of chemical changes going on in the process of respiration. When we breathe, air is taken into the lungs, penetrating the delicate vessels on their surface, the oxygen of the air enters the blood,

and is carried by it, through the heart, to minute capillaries in the different organs. Here it unites chemically with the particles of carbon from the tissue, and heat is generated. Carbon dioxid, the new substance formed by the chemical action, is carried by the blood into the lungs to be exhaled, while a fresh supply of oxygen is obtained for a repetition of the process.

Heat is generated wherever oxidation takes place ; and hence, wherever food stuffs are being converted into the more highly oxidated products, heat is necessarily evolved. These processes are taking place in all parts of the body by which vital activity is manifested, and hence every bit of tissue, being traversed by capillary blood-vessels, is really a small fire-place in which heat is being evolved, in proportion to the activity of the chemical changes which are going on.

The production of heat from the actions of organic life depends on the amount of material for the support of such actions—on the quantity of oxidizable substance introduced as aliment into the body, and on the supply of oxygen. Feeble and inactive young use up less oxygen proportionately than adults, and when exposed to cold, lose their heat and also their sensibility.

During the development of the chick within the egg the nutritive material needed for the growth of the blastoderm, and subsequently of the embryo, is supplied by the yolk, while oxygen of the air passing freely through the porous shell, gains access to all the tissues both of the embryo and yolk, either directly, or by the intervention of the allantoic vessels. From the very first oxidation is going on in the blastodermic structures, but the amount of oxygen actually withdrawn from without is probably exceedingly small in the early stages, as nearly the whole energy is directed to the building up of the structures, the expenditure of energy in the form of heat being extremely small.

REGULATION.

Heat is not only being constantly generated in, and distributed through, the body, but it is subject to incessant regulation. If there were no greater loss of heat than that given off to surrounding media by what we shall learn to know as conduction, radiation and convection, the temperature of the animal body would soon rise to such a height, when the external temperature was great, as to interfere with its vital functions. This most important refrigerating process, which acts as a counter-balance, or temperature regulator, is to be found in the varying, but constant, loss of moisture from the body. This loss of moisture is effected through the medium of the lungs and by the secretion of sweat from the surface of the body, which, being poured out of the perspiratory ducts in a fluid form, and carried off as vapor, by the atmosphere, necessarily renders latent a large quantity of heat energy, and thus diminishes the sensible heat of the exhaling body.

Or, in other words, the effect of the evaporation is to reduce the temperature of the evaporating surface. When water is converted into vapor, heat is consumed in overcoming cohesion, or that force which binds the molecules of water together, and cold is produced, the heat being carried away with the vapor. Every drop of water which is converted into vapor carries away as much heat as would raise the temperature of a similar drop about 500° higher if it were not evaporated.

Evaporation takes place constantly from the surface of the animal body, and thus it assists powerfully in maintaining the equable temperature essential to health. Perspiration usually passes away at once as invisible watery vapor, but when it is profuse a part may remain for a time as a fluid on the skin ; the former is spoken of as insensible, and the latter as sensible perspiration. Considerable watery vapor is also constantly being carried off by the breath exhaled, amounting to about two-thirds as much as that thrown off by the whole surface of the body. This can be made perceptible to the eye by breathing against a pane of glass. It is also seen as a dense mist on a winter's day, caused by condensation on coming in contact with the cold air.

This powerful heat regulator enables the animal economy to resist very high temperatures when the external conditions are favorable to a quick evaporation of the exhaled fluid. Thus the oven girls of Germany, clad in thick socks of woollen, to protect the feet, enter ovens where all kinds of culinary operations are going on, at a temperature often above 300°, although the touch of any metallic article while there would severely burn them. Persons have been subjected for a considerable period in a dry air to a temperature of 210°, without much inconvenience, while exposure to watery vapor of 125°, or immersion in water of 113° cannot be continued for many minutes.

HEAT A STIMULANT.

Heat is the immediate stimulus supplied by the hen to arouse the sleeping energy of the blas-

toderm to vital action, and it is upon this external source the embryo is dependent for the warmth necessary to its full development. For the same reason we shall need to supply heat to the egg in artificial incubation, and in order to do it intelligently we shall need to know as much of heating by combustion as we have already learned regarding animal heat.

HEAT STORED UP IN THE VEGETABLE.

The sun is our great source of heat, whose rays alone make the earth inhabitable. All the combustible material on the earth would not supply the want of the sun for a single day. In fact, if we did not originally have the sun, we would have had no combustible material, as those materials are only stored up by heat energy derived from the sun. The elements—nitrogen, hydrogen, carbon, etc.—of the primary organic compounds, are drawn from the air and soil and metamorphosed into vegetation through the action of the sun. That is, the energy emitted from the sun, under the forms of heat and light, is capable, through the medium of the plant, of disengaging oxygen from its combination with carbon in carbon dioxid, and hydrogen in water, leading to the formation of reoxidizable compounds ; and the energy evolved from the re-oxidation of these compounds, whether by combustion in the air or within the animal system, represents or forms the equivalent of that employed in effecting their construction. Our coal-fields represent a vast magazine of force drawn ages ago from the sun's rays, which is capable at any moment of being set free by the occurrence of oxidation.

HEAT LIBERATED BY COMBUSTION.

The vegetable products are devoured by the animal, and through the chemical action taking place in the body, the force heat is liberated, which was originally absorbed from the sun, while the gases are set free. This force liberated in the animal system we call animal heat. If we burn the vegetable products in air, what we call combustion takes place, which is the common source of heating, by which the temperature of any particular body is increased. Fire gives warmth, because the combustible part of the fuel takes on a new form of existence, being chemically combined with the oxygen of the atmosphere, and heat is evolved. This source of heat, then, is due to a change of state in bodies, and is entirely limited by the amount of substance suffering change, and ceases when the change is complete.

During the chemical change the same sort of heat energy is liberated as that which is liberated in the animal system, while the gases are likewise set free. The only real difference between the two kinds of combustion is that in the animal system the process is conducted with an extreme degree of slowness, and we have a low degree of heat, while in the ordinary fire the combustion takes place rapidly, and the heat being evolved in a much shorter time is proportionately the more intense. In both instances, whatever increases the supply of oxygen, increases the intensity of the heat liberated.

APPLYING HEAT TO THE EGGS.

In natural incubation the eggs are placed beneath a heat-generating body, and covered in with down and feathers. In this position they are warmed principally by conduction, and secondarily by diffusion or conveyance—both interior and exterior of the shell.

An unincubated egg is a very poor conductor of heat. The shell, however, is one of the very best conductors, and to it the more uniform heating of the egg is at first due. In illustration, if a piece of muslin be smoothly wrapped around an egg, it may be held in the flame of a lamp until the whole egg is hardened without the muslin's burning, so rapidly does the shell conduct the heat away.

In addition to the high conducting power of the shell, through the rapid development of the vascular system, the blood circulation soon aids in the distribution of the external warmth. Moreover, in natural incubation we have supplementary external aids of considerable value ; *i. e.*, the tendency of the heated air to diffuse downward through the feathers covering in the eggs, as well as outward, and of the feathers to hold, entangled around the eggs, a comparatively large volume of warm air. The air in contact with the heating body becomes warmer than the outside atmosphere, and tends to diffuse outward through the feathers, cooler air taking its place, though any rapid movement is held in check by frictional resistance. Thus it is seen that the heat is to a large extent retained around the eggs by the maze of fluffy feathers.

TEMPERATURE OF THE EGGS.

I find the temperature of the eggs will average up at the end of the first day of incubation at about 97½°. At the end of the second day at

98¼°, and from this time on will gain uniformly ¼° a day until the end of the eleventh day, having a temperature at that time of about 100½°. During the next two days the temperature rises to 101½° or 102°, and remains more or less stationary at 102° until the end of incubation.

The eggs tested were from a mixed lot of hens, and the sitters were common barnyard fowl. The figures given are the average of from five to eight registrations each, and represent, for the most part, the temperature of the great mass of the egg only, the temperature of the blood in the vascular system probably being somewhat higher.

A SPECIAL THERMOMETER.

The thermometer used was made especially for the purpose, and contained the least possible mercury, and had the largest amount of surface exposure that it was practicable to make. The instrument was so delicate that it would register from 4° to 6° above the temperature of the air when exposed to the radiant heat an inch from the palm of the hand, and was sufficiently delicate to show a difference of ½° in different parts of the egg.

GETTING THE TEMPERATURE.

In testing, the egg was removed from the nest and wrapped in warm flannel; a small hole, about one-eighth of an inch in diameter, was cut in the broad end of the egg, and the thermometer, already warmed to 98°, was quickly introduced into different parts of the egg without mixing the contents any more than possible. A correction of ⅖° was allowed, which probably more than covered the amount of heat lost. A difference of ½° could be detected between the temperature of the centre of the egg and the parts near the surface, while one side seldom registered as much as ¼° higher temperature than the opposite. Only eggs that were well covered were taken, and only those containing live germs counted. Unfertile eggs ranged from 96° to 98° throughout the hatch.

The one or two fertile eggs left in the nest in each sitting hatched by or before the close of the twenty-first day, and but three dead germs were found in all. All the eggs showed a remarkable uniform temperature at the different periods, seldom varying as much as one degree either side of the figures given.

PROBABILITIES.

Notwithstanding the delicacy of the thermometer used, it is probably impossible to get the temperature in the region of the germ-spot, or later of the blood in the vascular system before the twelfth day, with so crude an instrument as a thermometer. The egg undoubtedly attains a superficial temperature at first of 100° over that portion which is in immediate contact with the incubating body, and during the first days of incubation the germ must partake of that temperature to a greater or lesser extent, as it lies immediately beneath the shell in the neighborhood of that portion which is nearest the source of warmth.

THE MAXIMUM TEMPERATURE.

The great body of the egg, however, does not reach its maximum temperature until the twelfth or thirteenth day. By this time the allantois extends three-fourths of the way around the egg, and its blood-vessels lie immediately beneath the chorion and shell membranes, while the vessels of the yolk-sac have nearly enclosed the yolk. It will thus be seen that the heat applied to any one portion will at this time be rapidly diffused by the blood throughout the contents of the egg.

TEMPERATURE OF THE HEN.

If during the first few days of incubation we place a suitable thermometer beneath the hen, in about the same position as the eggs are placed, there will be imparted to it a temperature of about 101° only, although a glass placed in the rectum will register from 109° to 110°, and if the hen is killed without bleeding, an opening quickly made through the side, and a delicate thermometer thrust into the region of the heart, it will register from 112° to 112½°. By the end of the first week of incubation the temperature in the rectum will be about 109°; by the end of the second week it will have fallen to 108°; and sometimes by the end of the third week to 106°. One hen with a rectum temperature of 106 at the end of incubation was killed the fourth day following, and was found to have a temperature in the region of the heart of 110°.

RELATIVE POSITION OF THE EGG.

During the early stages of incubation the eggs cannot be said to be, to any great extent, in direct contact with the incubating body, as a layer of down and feathers intervenes; but, as incubation progresses, the feathers covering the abdomen either fall or are plucked off, and the eggs are then brought in direct contact with it; so that, notwithstanding the greater body temperature of the hen at the commencement of incubation, the

temperature of the surface which imparts the warmth to the egg is not much inferior during the later stages of incubation to that of the earlier; owing to the change in the relative position of the egg, and to the greater advancement of the incubating plexus, which brings more and more warm blood to the surface of the abdomen.

HEAT IS DEVELOPED.

The eggs themselves develop very little heat up to the eleventh day. By the eleventh day the structural development of the chick is about complete, and from this time on less external warmth is required to maintain its temperature; a small amount of heat being now developed by the chick in the absorption and oxidation of the remaining nutrient material, the chick growing rapidly, and some little excretion appearing in the allantoic fluid and in the intestines.

HIGHER SUPERFICIAL TEMPERATURE.

Although up to the twelfth or thirteenth day the great mass of the egg has a somewhat lower temperature than 102°, it is probable that it has a superficial temperature in the neighborhood of the germ of from 100° to 100½° even at the first. This assumption is based upon the fact, noted from a series of careful experiments, that if the eggs are maintained at a temperature rising from 98° to 100°, the development at seven days is from twenty-four to thirty-six hours behind that of the same period under natural incubation. When the eggs are incubated at an initial temperature of 100½°, gradually rising to 102° by the eleventh day, and maintained at that degree for the balance of incubation, the chicks are usually all excluded by the middle of the twenty-first day; that is, if the eggs are not subjected to too frequent and prolonged exposure to a cold atmosphere. In the latter case the eggs will need to be maintained at a higher temperature during the entire period. When the eggs are maintained at a temperature of 100½° to 102°, and subjected to little or no exposure to a cold atmosphere, the embryonic development is found to correspond approximately to that under natural incubation.

COOLING THE EGGS.

If an abundance of food and water is placed where it will be accessible to the hen when she leaves the nest, it will be found that, if left to herself, a successful sitter remains on the eggs two, three and even four days at a period when the air is chilly, without leaving them, while in warm weather she may be gone hours at a time. In exposing eggs to the atmosphere two facts must be taken into consideration. When the hen returns to the nest the eggs quickly regain their normal temperature; while, when the eggs are removed from an incubating chamber under artificial incubation, they are some time warming up when replaced. Under the influence of an atmospheric temperature of 65° the eggs, during the early stages of incubation, will lose heat at about the rate of 1° each two minutes. Under an atmospheric temperature of 35° they will lose more than a degree a minute. When replaced in the incubating chamber it takes as long as one, two or even three hours to regain the desired temperature, the length of time required depending on the degree to which the hatching chamber as well as the eggs were cooled. It has been held that the eggs need to be cooled in order to absorb fresh oxygen, but this view arose through ignorance of the laws controlling the movement of gases, and is entirely fallacious.

EGGS DIFFER.

Eggs from different breeds will vary in the time required for incubation; the eggs from the lighter and more active breeds usually hatching in somewhat less time than those from the heavier and less active. Different eggs from the same pen and breed of birds, however, will vary as much as fifteen hours in the time required for the exclusion of the chick. This fact probably accounts for a part of the difference in temperature of two eggs lying side by side under a hen, as the difference in temperature cannot be entirely due to the difference in position. I find two fertile eggs lying side by side in an incubating chamber sometimes vary as much as a full degree. In this case, however, a part of this variation is due to a physical difference in the eggs, as well as to a difference in position of the eggs in reference to the heating surface, cooler walls and unfertile eggs.

THE CORRECT TEMPERATURE.

In view of the fact that when the eggs are incubated at a gradually rising temperature of from 100½° to 102° by the eleventh day, the embryonic development corresponds approximately to the development under natural incubation, we can reasonably infer that this is the temperature at which the eggs should be maintained. When incubating at a temperature of 100° for the first three days, 101° for the next four, 102° for the following five, and 103° for the balance of incubation, the chicks are excluded from the middle of

the nineteenth to the middle of the twentieth day ; but at the seventh day the development is about equal to that under natural incubation. In incubating at a temperature of 101°, 102° and 103°, respectively, for the three weeks required, will also exclude the chick too early ; but the difference in development from that under natural incubation at the earlier periods is not particularly marked.

The reader will bear in mind that the temperature of the egg is spoken of, and not that registered by the thermometer when lying on it.

EXTREME TEMPERATURES.

A high temperature during the earlier stages of incubation is usually fatal. This is undoubtedly due to too rapid chemical changes in the protoplasm under the influence of a high temperature, causing undue cell metabolism. The opposite to this probably occurs when the germ starts to develop under a low temperature (80° or 85°), and the vital spark is extinguished.

After the eleventh day a temperature of 110° or 112°, if not too prolonged, is not necessarily fatal. At this time the temporary embryonic appendages—the circulation of the yolk-sac, or digestive system, and the allantois, or lungs—are about completed, and the surplus heat is taken care of in somewhat the same manner, although in a much inferior degree, as in the adult system. The greatest excess of heat for a short period can probably be withstood after the sixteenth day, when the growth of the allantois is completed.

Experience proves that eggs can be placed under extreme conditions, both before and after incubation commences, and still retain their vitality, and, other conditions being equal, capable of producing a live bird. Nevertheless, there is unquestionably a certain temperature at which eggs may be kept for the longest period without affecting their vitality, a certain incubating temperature to be maintained for the best possible results to be produced, and certain mechanical and atmospheric conditions to be observed from the time the egg is laid until the exclusion of the chick. Simply because a puppy will live for fifty minutes under water, are we to leave him out in every shower? Or, because the human body can exist under a temperature of 300° in a dry air, do we wish to run the temperature of our living rooms up to that degree two or three times a day? The vicissitudes of temperature, climate, and other conditions under which living organisms will continue to exist, are extreme, indeed, and the limitations are usually proportioned to the changes the individual has normally to withstand; but in all organic life the highest development is only attained under particular, narrow, and usually well defined limits.

THE TEMPERATURE AT WHICH TO KEEP EGGS.

In determining the temperature at which eggs for incubating purposes should be kept, we shall need to first consider the effects of a greater or lesser temperature.

We know that the germ development is continuous with fecundation, and that after the egg is laid and its temperature allowed to fall to 50° or 60° the germ lies nearly dormant, but not entirely so, for eggs kept two weeks at a temperature of 60° will incubate in several hours' less time, on an average, than newly laid eggs. If the temperature is gradually raised from 60°, metabolism grows more and more rapid, and at 102° the process of incubation may be said to be at its height.

If the germ does not lie absolutely dormant at 60°, and a greater temperature causes a more rapid development, under a lower temperature we may reasonably expect metabolism to be still less active. Undoubtedly this is the case, and if so, the lowest temperature consistent with the continued life of the germ is the degree at which the eggs should be kept.

If the egg be frozen, the constituent cells of the blastoderm and food-yolk are disarranged and broken up, and the vital spark extinguished, and upon thawing out, the egg quickly becomes putrid.

The freezing temperature is too low a degree, therefore, at which to maintain the eggs, and as the first effect of this temperature is produced at 39°, it is obvious we should not allow the eggs to fall to this point.

Experience has proved that eggs can be kept best for the longest period when desired for eating purposes at a temperature of 40°, and at 50° to 60° to maintain the vital spark the longest. When the temperature falls to the small end of the forties for any length of time the eggs do not hatch well.

MANNER OF KEEPING EGGS.

Many opinions have been expressed as to the manner in which an egg should be deposited and handled when keeping for incubating purposes. Some advise standing on the small, and some on the large end; while others, to stand on end and reverse the position every day. The theory has been that if allowed to remain in one position, the

yolk, being heavier than the albumen, would cut through and stick to the shell, and it was thought that if stood upon end and turned from day to day this would be prevented.

The striking error in this theory is in regard to the weight of the yolk. The yolk is specifically lighter than the albumen, and would no quicker cut through the latter than a cork would sink in water. In fact, the yolk is buoyed up by the albumen, and the germ, which always lies on top, is only kept from pressing against the shell by the weight of the denser albumen forming the chalaza, the latter having a tendency to drag the yolk down and steady it.

If the eggs are kept for too long a period at too high a temperature, the albumen gets somewhat fluid, its arrangement is broken up, and the yolk is then pressed upward with some force against the shell, and if allowed to remain in this position will eventually dry to it.

It is probable that any period of time and degree of temperature sufficient to break up the natural arrangement of the albumen would destroy the vitality of the germ ; and the egg would be useless for incubating purposes whether or not the yolk was dried to the shell. It is obvious, too, that the more handling the egg receives, the quicker will this disarrangement be effected.

I have had no occasion to keep eggs for a longer period than three weeks, and know of no reason why they should be kept for a longer one. When keeping eggs for this period, and also for shorter ones, they have been placed in a basket or box of some sort without any regard to position, covered over with a cloth to check any draft that might strike them, thus preventing undue evaporation, and left undisturbed until wanted. Any cloth will give sufficient ventilation to keep the air around the eggs sweet ; that is, if the air in the apartment in which they are kept is pure.

When incubating without turning the eggs, no difference has been observed in the number of germs dried to the inner membrane when the eggs were stood on broad end or laid in their natural position ; almost twice as many, however, will dry to the membrane separating the albumen from the air space in the broad end when the eggs are placed on the small end.

APPLICATION OF HEAT.

As was shown in an earlier part of this chapter, 100½° at the initial stages, gradually rising to 102° by the eleventh day is probably the correct incubating temperature for hens' eggs. We have now to consider how we are to maintain them at that temperature. The atmospheric conditions to be maintained during incubation will be discussed under the head of ventilation.

In artificial incubation an equable distribution of heat over a comparatively large surface is first to be desired. This is very difficult of attainment, the reasons for which are obvious.

In the first place, as a basis of discussion, let us take an incubating chamber, say 36 inches square, 12 inches in height, with egg trays placed 5 inches from the bottom. Such a chamber will hold 350 to 400 eggs. This is as large as it has been found practicable to make a hot-air machine, and about as small as it is economical to make one heated through the agency of hot water.

AN UNEQUAL TEMPERATURE.

We will say the heating body comprises the entire upper chamber. Suppose this heating surface has been brought to an uniform temperature by some means and all the direct heat rays given off are of equal energy. If we now place several thermometers in the machine, and note their temperature, we will find those in the centre registering the highest, those a little farther towards the sides a lesser temperature, and those nearest the sides the lowest. It is evident, then, the sides are giving off less radiant energy than they are absorbing, causing a loss of heat to the chamber. As it is quite impracticable to make a case that is a perfect non-conductor, we shall always have this feature to contend with.

The loss of heat energy is felt to the greatest extent in that portion of the chamber near the sides, for the reason that radiant heat diminishes in intensity as the square of the distance from the radiating surface increases. The distance being the greatest at the centre of the chamber from the surface where the loss of warmth occurs, that portion is the least affected.

AIR CURRENTS.

The air within the chamber is warmed by coming in contact with the various hot surfaces, and air currents are established which travel in almost every direction. Where there are extreme inequalities in the radiant energy at different points within the chamber, the movement of the air tends to equalize the temperature, and does so to a moderate extent ; but as long as there is a source of heat within the chamber, just so long will inequalities of temperature be found in the air, as well as in the other bodies within the chamber. This is the case even where the radiant heat is to a large extent equalized by creat-

ing inequalities of temperature in the heating surface.

EQUALIZING THE RADIANT ENERGY.

We will now consider the effect of equalizing the radiant heat within the chamber by creating inequalities of temperature in the heating body. This may be done for any particular temperature by directing the flow of hot water or air over the heating body, but the same inequalities will not answer for all temperatures. For instance, we will say that the temperature of the air around the machine is 80°, the highest atmospheric temperature in which any machine should be operated.

At this temperature the loss of warmth through the medium of the walls or casing of the chamber is at its minimum. We now direct the flow of hot fluid in such a manner that it warms the heating body near the walls of the chamber to a certain degree of temperature above that at the centre, the temperature of the intermediate points being graduated proportionately. If we have correctly estimated the difference in temperature required, we will now find that the greater radiant energy given off by the heating body near the walls of the chamber offsets exactly that which is absorbed, and thermometers now placed in different parts of the chamber will show that they are all receiving the same amount of radiant heat.

We will now take this machine, the hatching chamber of which was equally heated when surrounded by an atmospheric temperature of 80°, and place it under an atmospheric temperature of 35°, about the lowest temperature in which any machine should be operated. The loss of warmth is now at its maximum, and we find that the greater warmth of the heating body near the walls of the chamber no longer offsets that absorbed. We shall, therefore, need to increase the inequality of temperature of the heating body under the new conditions. It is thus obvious that an incubating chamber cannot be constructed so that it will maintain the eggs at an equable temperature under all conditions, and that the best we can do is to construct the chamber so that it will have an equable temperature when placed in the mean of the atmospheric temperatures in which it is going to be operated. If this is done, and the walls are properly constructed, the greatest variation need not be more than 1°, or possibly a little less. The corners will show the greatest variation, for the reason that the surface of absorption (the wall area) is relatively larger at these points than the surface of the heating body. A round chamber would be the model shape, but this would be impracticable to construct, besides being inconvenient to operate.

OFFSETTING INEQUALITIES OF TEMPERATURE.

To offset any differences in temperature, the relative position of the eggs should be reversed. This may be quickly done by simply turning the trays around so that the cool side takes the place occupied by the warmer. If this is done twice a day, say when the eggs are turned, a difference of 1° in temperature will do no harm. Even greater differences of temperature in the different parts of a machine may be offset, to a great extent, by shifting the location of the different trays.

RELATIVE TEMPERATURE OF THE EGGS.

We will now follow the relative temperature of the eggs through a period of incubation. Let us suppose the hatching chamber has an equable temperature, and the temperature of the heating body, as well as that of the outer atmosphere, to remain stationary throughout the entire period. From our present point of view all the eggs would thus be under perfect thermal conditions if they were at the proper temperature to start with.

During the first ten days of incubation the metabolic changes are directed toward the building up of the embryonic structure, little energy being given off in the form of heat. During this period there is, therefore, nothing to disturb the relative temperature of the eggs. About the eleventh or twelfth day of incubation, the embryonic structure being about completed, catabolism, or destructive metabolism becomes somewhat active, and heat energy is liberated, which increases the temperature of the fertile eggs. As the unfertile eggs can generate no warmth, they now absorb some of that generated by the fertile eggs opposite them, the latter being prevented from gaining a temperature equal to that of the fertile eggs surrounded by heat-generating eggs like themselves. The unfertile eggs should, therefore, be removed by the tenth day.

SPREADING THE EGGS OUT.

After removing the unfertile, the fertile eggs should be spread out so as to occupy about the same relative position to one another. If this is

not done the temperature of the eggs will vary quite considerably. That is, the eggs in a full tray will have a higher temperature than those in one but half full. A number of eggs bunched together in one end, even, will have a higher temperature than the few that may be scattered over the remaining portion of the same tray. The difference in temperature may only be 1° or 2°, or even less, but whether or not artificial incubation is successful depends upon an equable temperature more than any other one thing.

AN APPROXIMATE AIR TEMPERATURE NECESSARY.

The reader will appreciate the force of the above remarks better, if he has not already observed the inequalities of temperature under the conditions cited, by bearing in mind the fact that, though the eggs attain their temperature through the agency of radiated heat, it is necessary for its maintenance that the medium around them has an approximate temperature, as otherwise their heat would be too quickly carried away. The eggs and nearby surfaces receive the radiant heat, become warm, and impart a portion of their warmth to the air which is banked up around them by the walls of the chamber. This process is carried on, the eggs gaining warmth from the heating body above, and the air in turn receiving it from the eggs, until the loss of warmth through the walls just offsets that supplied to the heating body. When the eggs begin to generate heat, a portion is given off to the air.

If now we have a full tray of heat-generating eggs, all these eggs take part in warming the air about them, and the loss to each egg is proportionately slight. On the other hand, if there are but a few eggs scattered about, there is a larger body of air for each egg to warm, and the loss of heat by each egg is greater, and their temperature falls below that of the eggs where there are a number together. Thus it is seen that unless the eggs are evenly distributed in all the trays an equable temperature cannot be maintained.

THE HEAT MUST BE REGULATED.

Up to the present time we have spoken of the eggs as being subjected to a certain fixed degree of heat, imparted to them by a fixed temperature in the heating body above under a fixed atmospheric temperature. This is practically a theoretical condition, for in practice we will need to regulate the temperature of the heating body so that the heat given off by it will be just sufficient to offset that lost by the chamber when placed under various outer atmospheric temperatures. We can reduce the temperature of the air and eggs without reducing the temperature of the heating body by giving more ventilation, and thus replace the warmer air with that of a lesser temperature; but this method is not a desirable one, the reasons for which will be cited when considering the subject of ventilation.

Before considering the regulation of the temperature of the hatching chamber, however, we will need to know when its temperature is at the desired degree; or, what is of more importance, and sometimes considerably harder to ascertain, what is the degree of temperature of the eggs.

A GOOD THERMOMETER.

To start with, we shall need to secure a good thermometer. Many comparatively new glasses are still put out, and after the tube ages they register half a degree or more high. This will not make much difference if we know what the correction is. In scientific work requiring their use, the thermometers are always tested from time to time, and the correction ascertained. After a thermometer is a year and a half or two years old, further aging will change it very little. A new glass will change the most during the first six months, at which time some manufacturers graduate and place on the market.

There should always be a good standard thermometer on every place, and when a new glass is bought, it is easy to learn the correction, if any, and to test it from time to time afterwards. A good way to test a thermometer is to place it, together with one known to be correct, in a body of water which has been previously heated to 105°. Allow the water to cool down gradually, and note the temperatures of the two as they fall through 5°. The water will need to be continually stirred, for otherwise all kinds of temperatures can be detected in it, and we would not know when the two thermometers were receiving a like amount of heat.

THE TEMPERATURE OF THE EGG.

To ascertain the temperature of the egg without breaking it, is impossible with the use of a thermometer. If we place a thermometer so that the bulb rests upon a fertile egg, it does not necessarily give us the temperature of that egg. Where the eggs are placed under radiated heat, as in all other machines, the difference in temperature between the thermometer and egg will be determined by the temperature of the heating

body. In cold weather when the temperature of the heating body is the greatest, there will be the widest difference while the atmospheric temperature is high, and that of the heating body correspondingly low, the two more nearly approach each other.

During the later stages of incubation, when the temperature of the heating body is not only influenced by the atmospheric temperature, but by the number of fertile eggs contained in the chamber, the temperature is more difficult to determine. Moreover, the temperature of the heating body will need be greater at all times in a machine with poorly constructed walls, than in one with first-class non-conducting walls. If we know the temperature of the heating body at all times we can estimate the temperature of the egg, but very few machines are so constructed as to render this possible. It is thus seen that there was no degree of temperature at all constant by which to regulate the heat of the chamber.

In the Cyphers the air is heated before it is brought into the egg chamber, and the eggs are warmed by contact with it, which is nearer the natural method than by radiation from a hot body placed at a distance. Under this system the air and eggs have a constant relative temperature, and by hanging the thermometer just above the eggs we can secure an average temperature of all the eggs and obtain the best possible results.

HEAT REGULATION.

Other things being equal the machine that has the best regulator has the advantage over its competitors. The best heat-regulating devices are not put on incubators—they are too delicate for general use; the same as the delicate balance used by the chemist in making a quantitative analysis would be of little use to the merchant in weighing out sugar. The apparatus that the merchant uses, however, is sufficiently accurate for his purpose, and the heat-regulating device we adopt will need be sufficiently accurate for ours.

THE LIQUID THERMOSTAT.

A form of thermostat that is used for incubator and various other purposes consists of a thin sheet-metal capsule containing fluid of a low boiling point. Another form consists of a large tube in which the liquid is confined by a column of mercury, which is forced into a receiver to overbalance a lever. For incubator purposes these regulators are of but little value. The expansibility as well as the boiling point of a liquid under pressure will vary considerably though the pressure remains constant. Under the usual conditions this regulator will require 2° of heat to work it. A constant variation of 2° is not necessarily fatal to successful incubation, but the best results cannot be obtained under such circumstances.

There is 1° variation in the relative temperature of the eggs when the heat is almost absolutely constant, besides the usual inequalities of 1° or more to be found in almost all large machines, and if a greater amount is added to this it obviously is not desirable.

Again, the boiling point of a liquid being determined by the pressure upon it, changes in the atmospheric pressure runs the usual variations of 2° up to 4° or 5°. The atmosphere exerts a pressure sufficient to raise mercury in a tube from twenty-seven to thirty-one inches, these being the usual extreme variations. The common variations are about two inches, which is equal to about one pound pressure to the square inch. The atmospheric pressure is varying somewhat all the time, the greater variations being in winter, when the machine is most in use. Every change which occurs in the atmospheric pressure will cause the heat to rise or fall. The machine may run steady for several days, when you are called away at the time of hatching. There is a storm coming up, the atmospheric pressure grows less, allowing the liquid to expand; the heat is shut off and the temperature in the hatching chamber falls 4° or 5°. The hatch is ruined, as the chicks will not come out when the heat goes down. If the adjustment is changed the machine needs watching until the hatch is over, as should the atmospheric tension change the heat will go up 4° or 5° and scald the chicks.

INDIRECT REGULATORS.

Many incubator manufacturers take advantage of the expansion of the heating fluid to regulate its temperature and insulate the machine so that it will not be subjected to rapid thermal changes in the outer atmosphere. Where the machine can be kept in a closed underground apartment, this works very well, and where the expansion of water is utilized, a constant degree of temperature can be maintained so long as the temperature of the surrounding medium does not change. During the colder months, when the apartment is usually kept closed, the variations in its temperature are not great, and a fairly uniform temperature can be maintained in the incubating chamber. But, when incubating in the

early fall and late spring the apartment must be ventilated, and its temperature changing with that of the outer atmosphere, the temperature of the incubating chamber must also follow it to a certain extent, as it is impracticable to construct the walls of the chamber so that they will be absolutely non-conducting. These machines should not be bought with the intention of running them in an ordinary living room, barn or shed. Under these conditions it would be difficult to keep an even temperature by constant watching, as the regulating mechanism needs adjusting to offset the outer thermal changes.

THE EXPANSION OF AIR.

The expansion of a body of air above the water in the heating tank is utilized to a large extent, and has been patented in a number of combinations. Many of the machines using this principle were still-born, or never reached maturity. This principle is open to the same objections as those cited in the case of the expansion of water, with the additional one that air being very compressible, its temperature, as well as that of the water and egg chamber, rises and falls with every atmospheric change. The changes from this cause alone are from 2° to 5°, according to the amount of air confined.

BAR THERMOSTATS.

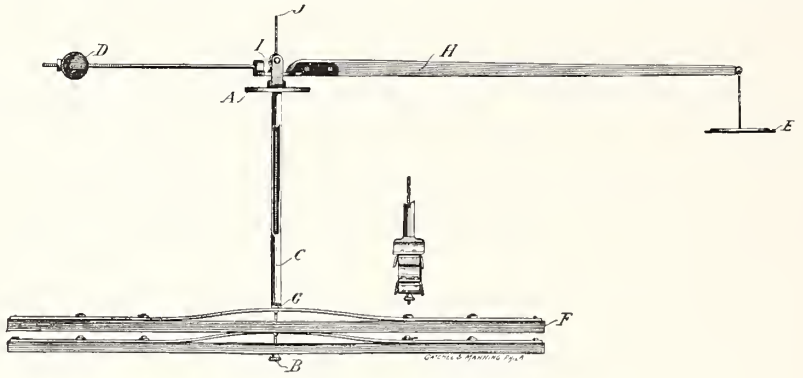
Many thousands of dollars have been expended by different individuals in trying to get a thermostat powerful enough to do work and still be sensitive and accurate. There have been two favorite styles, the single rubber bar, and two metals riveted together. With the single bar the lineal expansion was multiplied by a series of levers, one communicating with another. With this thermostat the motion is so slight that it needs to be multiplied many times. The greater number of times a given motion is transferred and multiplied in the transferrence, the less uniform is the amount of motion given off.

A thermostat composed of rubber, brass or aluminum riveted to a strip of sheet steel, is quite universally used, but in this case the leverage is so great at the base that it makes the action so weak that it varies more or less, even when the work to be done is very slight.

THE CYPHERS REGULATOR.

The regulator used in the Cyphers is built on entirely new lines, and no other practical regulator has ever been devised that is its equal, either in durability or exactness. In the Cyphers simplicity and conformity to natural laws, are among its notable points. Sensitive and positive in action, this thermostat surpasses all other regulators.

The thermostat is composed of aluminum and steel. The former metal has more expansibility than any other that it is practicable to use. While others have employed the same metals, they have riveted them together, making a weak compound lever, uncertain of action. In the Cyphers a strip of cold rolled sheet steel is taken, and its edges bent downward at right angles, so that it will resist bending strains, and is wonderfully strong in resisting compressive or tensile strains acting along its axis, where the strain in this thermostat comes; so that it would withstand a pressure of a thousand pounds.



THE CYPHERS REGULATOR.

To two rigid pieces of steel are riveted firmly at the ends (*F*) four pieces of aluminum of suitable thickness. As the aluminum expands more than the steel the increasing length must go somewhere, and by the use of sliding ties the movement is all thrown to a dead centre in the middle, where the aluminum forms a bow. Upon cooling the aluminum contracts, and as it cannot possibly

bend the steel, the bow is decreased as the aluminum is drawn back with the force of all its tensile strength. It must go and come in one place; it can do nothing else. As four pieces of aluminum of 24 inches length are employed, it gives a combined movement of four 24-inch thermostats, with much more uniformity in action than where the aluminum is made to bend the steel, as is the practice in other makes.

The thermostat is connected above by a brass tube (*c*), through which runs the connecting-rod (*J*). The lever rests on hardened steel knife-edge bearings, as does also the top nut (*I*) on connecting-rod. The top work (*a*) is a substantial casting. The combined movement of the aluminum is there multiplied eight times to the inch of lever length, and that without the least friction or a particle of lost motion. There is nothing to wear out, or get out of order, and its working cannot be interfered with by the chicks or ordinary rough usage. To sum it all up, it is the most *substantial*, *sensitive* and *accurate* regulator in existence.

Those who have had experience with other regulators can readily understand the value of our thermostat, and those who are not familiar with other regulators will easily comprehend the merits and workings of this one. Wide variation in outside temperature has no effect on this regulator. Sudden changes of temperature in many machines of the present day will throw the thermometer in the incubator off from 4° to 5°, and even more. This is not so with the Cyphers. It *will not vary*.

In the application of heat and the regulation of temperature in artificial incubation, it should be made as uniform as it is possible to make it. There are atmospheric conditions that are of equal importance as an even temperature, and which are equally as hard to maintain, and if we allow one condition to vary here, and another there, we cannot expect to get the best results. In fact, unless there is an equal balance between the heat and atmospheric conditions, incubation cannot be carried to a successful exclusion.

PROMINENT CUSTOMERS SAY:

I never found an incubator that holds the even heat yours does; sometimes running for days and not varying one-fourth of a degree.

WM. H. TRUSLOW.

Stroudsburg, Pa.

They are almost entirely self-regulating.

GEO. H. POLLARD.

South Attleboro.

Your machines are not affected in the least by a variable temperature; set regulator for 102½ degrees and there it stays.

HORACE G. HUEY.

Woodbury, N. J

It is the only machine that you can leave from morning to night, from beginning to end of hatch and find the temperature the same in all parts of the machine and at all times.

F. C. RECORD.

Haverhill, Mass.

VENTILATION.

Respiration exerts an equally important, though not a more powerful influence than heat, over the embryonic development, as over the system of the adult fowl. The essential object of the process of respiration is the absorption or taking in of oxygen from the surrounding medium by the blood, with a corresponding excretion or throwing off of carbon dioxid. At first the germ-cell assimilates the yolk direct. As it develops, it gets too large to do without an apparatus by means of which the increasing amount of nutrient material essential to its growth may be obtained, and carried about from part to part, and the waste products disposed of. An extended absorbing or digestive tract, and a system of circulating vessels are therefore developed, and later special excretory organs for the elimination of useless or harmful substances.

The result of the process of digestion is the formation of a quantity of liquid material which can be taken up by the different cells, which are the fundamental form-element of every organized body, and used by them for the process of growth and repair. This liquid is for the most part that red fluid which we are all familiar with as blood.

The circulating vessels are a system of minute tubes, with very thin walls, termed capillaries, and are distributed through the whole organism. These tubes open into others, which are called arteries and veins, and, becoming larger and larger, at length open into the organ we know as the heart. The tubes and the chambers of the heart, with which they are connected, are all filled with blood. The walls of the heart are muscular, and contract rhythmically, or at regular intervals. By means of these contractions the blood which its cavities contain is driven in jets out of these cavities into the arteries, and thence into the capillaries, whence it returns by the veins into the heart again. This is the circulation of the blood.

The ultimate dependence of the embryo for its support and growth on the constant stimulus of this circulating fluid, the blood, demands the maintenance of its vivifying powers by its exposure to the atmosphere as urgently as the mere supply of its deficiency by the absorption of fresh nutriment. That is, the nutritive solution which is formed by the process of digestion, traverses the thin membrane which separates the alimentary tract from the cavities of the vessels in contact with it, and so enters the blood, with which they are filled. Whirled thence by the torrent of the circulation, the blood thus charged with nutritive matter enters the heart, and is thence propelled into the organs of the body. To these organs it supplies the nutriment with which it is charged; from them it takes their waste products, and so returns by the veins loaded with useless and injurious excretions. Those excretionary matters are separated from the blood by the excretory organs, of which there are three—the skin, the lungs and the kidneys.

Different as these organs may be in appearance, they are constructed upon one and the same principle. Each, in ultimate analysis, consists of a very thin membrane, with one face free, or in communication with the exterior of the body, and the other in contact with the blood which has to be purified. The excreted matters are, as it were, strained from the blood, through this membrane, on its free surface, and thence make their escape. Every one of these organs eliminates the same products, viz., water, carbon dioxid and urea, or some nitrogenous compound of like import. The lungs play a double part, being not merely eliminators of water and excretionary products, but they import into the economy a substance which is not exactly either a food or drink, but something as important as either, *i. e.*, oxygen. It is oxygen which is the great sweeper of the economy, which, introduced by the blood, into which it is absorbed, into all the tissues of the organism, seizes upon those organic molecules which are broken down by their work, lays hold of their elements, and combines with them into the new and simpler forms, carbon dioxid, water and urea.

The evolution of the circulating system by progressive changes in the development of the embryo, however, is not completed until the moment of birth. In the early stages of development there is a general or interstitial respiration. The oxygen of the air, passing freely through the porous shell and lining membrane, gains access to all the tissues, both of the embryo and yolk. As soon as the nutritive fluid and a central propelling organ are produced, the fluid is driven through the vessels of the vascular area, on the expanded surface of the yolk, and later through the vessels of the allantois, where it is exposed to the influence of the atmosphere through the coverings of the egg. For some time before birth the chick has a mixed action of life, for it breathes, and we can hear it pip and chirp.

All these modifications have reference to the exposure of the fluid to the atmospheric air, either in a pure state, or as contained in all the

substances of the egg, through the medium of a thin membrane, and it is obvious that a continual renewal of the air in contact with the outer surface of the membrane is necessary. This is accomplished by the diffusion of the surrounding medium through the down and feathers covering in the egg, and by the oxygen of the air immediately surrounding the egg passing inwards through the shell, effecting exchanges with the carbon dioxid which is expelled. The relative proportions which the oxygen absorbed, and the carbon dioxid exhaled, bear to one another, are determined by the law of the mutual diffusion of gases. By this law the volume of any two gases which pass through a porous medium to mingle with each other will be in the inverse proportion of the square roots of their specific gravities. The volume of oxygen that passes inward will exceed that of the carbon dioxid which passes outward in the proportion of 1,174 to 1,000. As carbon dioxid contains exactly its own volume of oxygen, it follows that 174 parts, or nearly 15 per cent., more oxygen is absorbed by the blood than is given out in the form of carbon dioxid. A portion of this excess of oxygen unites with sulphur and phosphorus of the original components of the egg, converting them into sulphuric and phosphoric acids, and the remainder combines with the hydrogen of the fatty matter to form part of the water which is exhaled.

THE DIFFUSION OF GASES.

The fact of the diffusion of gases was first remarked by Priestley. The laws of the phenomena were first investigated by Graham, who gave a life study to the miscibility of the gases. Repeated experiments have well established the fact that gases of a different nature, when brought into contact, do not arrange themselves according to their density—the heaviest undermost, and the lightest uppermost—but they spontaneously diffuse mutually and equably through each other, and so remain in an intimate state of mixture for any length of time.

The tendency of gases to mix with each other is so strong that it will overcome the greatest difference of specific gravity ; and, contrary to what a superficial consideration would lead one to expect, the more widely two gases differ in specific gravity, the more rapid is the process of intermixture. This process is termed diffusion, and may be illustrated by means of an apparatus consisting simply of two bottles connected together by a long glass tube. If we fill the upper bottle with hydrogen, and the lower one with chlorine, we shall find, in the course of a few hours, that the two gases have been perfectly mixed together, although the difference between their specific gravities is three times as great as the difference between the specific gravity of mercury and that of water. The chlorine, although thirty-six times heavier than hydrogen, will be found to have made its way into the upper bottle, as may be seen by its green color, while the hydrogen will have passed downward into the lower one, and, when once mixed, the two gases will never separate, however long they may remain at rest.

What has been shown to be true of hydrogen and chlorine is equally true of all other gases and vapors which do not act chemically on each other. The only difference observed with different substances is the time required to effect a perfect mixture ; but, when once made, this mixture, in all cases, continues uniform and permanent.

Graham observed that the diffusion of gases takes place through porous solid bodies, such as plaster of Paris and pressed plumbago, at a rate not very much less than when no such body is interposed. The diffusion or spontaneous intermixture of two gases is effected by an interchange in position of indefinitely minute volumes of the gases, which volumes are not necessarily of equal magnitude, being, in the case of each gas, inversely proportioned to the square root of the density of that gas. These replacing volumes of the gases are termed equivalent volumes of diffusion, and are as follows: Air, 1 ; water vapor, 1·2649 ; nitrogen, 1·0140 ; oxygen, 0·9487 ; carbon dioxid, 0·8091, etc., numbers which are inversely proportional to the square roots of the densities, the density of air being assumed as unity. If the two gases are separated at the outset by a screen having apertures of inseusible magnitude, like the plaster plug or the shell of an egg, the interchange of equivalent volumes of diffusion takes place through these apertures, being effected by a force of the highest intensity ; and, if the gases are of unequal density, there is an accumulation on the side of the heavy gas, and loss on the side of the light gas. In the case of air, for instance, on the one side of the screen, and carbon dioxid on the other, a process of exchanging one measure of air for 0·8091 of carbon dioxid, through the apertures, is commenced, and continues until the gases on both sides of the screen are in a state of uniform mixture.

Professor Henry, of Princeton, found that a solid bar of lead bent like the letter U, and one end of it put into a jar of quicksilver, which is

the only metal fluid at common temperatures, would, after some time, become so saturated with mercury by capillary action as to convey it out of the vessel to some degree as with a syphon. A lampwick draws up oil, or a blotting-pad absorbs ink through the same influence. On the same principle is explained the fact that different gases separated by a dry porous partition, or simply in contact will not remain separate, but will soon mingle uniformly, even against the force of gravity. It is on this principle that the constitution of the atmosphere is everywhere the same, although the two gases composing it are by weight in the proportion of 976 to 1,130.

In any discussion of respiratory phenomena in animals, however, it is necessary to bear in mind the fact that all living tissue, and nearly all liquids are capable of absorbing oxygen. Dalton, the distinguished chemist, first noticed that a bubble of air separated by a film of water from an atmosphere of carbon dioxid gradually expanded until it burst; and in like manner a moist bladder, half filled with air, in atmosphere of the same material became in time greatly distended by the insinuation of this gas through its substance. This effect is not the result of simple diffusion, as the thinnest film of water or of any liquid is absolutely impermeable to a gas as such. The result depends first upon the solution of the carbon dioxid by the water on one surface of the film, and secondly on the evaporation into the air from the other surface of the gas thus absorbed.

Similar experiments were made by Drs. Mitchell and Faust, and others, in which gases passed through a film of India rubber, entering into a partial combination with the material on one surface and escaping from it on the other. Prof. Graham not only considerably extended our knowledge of this phenomena, but also gave a satisfactory explanation of the mode in which these remarkable results are produced. He recognized in these cases the action of a feeble chemical force insufficient to produce a definite compound, but still capable of determining a more or less perfect union as in the case of simple solution. One of the most remarkable results of this peculiar mode of transfer of aeriform matter through the substances of solid bodies was an ingenious method of separating the oxygen from the atmosphere. The apparatus consisted simply of a bag of India rubber kept distended by an interior framework, while it was exhausted by a Sprengle pump. Under these circumstances the selective affinity of the caoutchouc determines such a difference in the rate of transfer of the two constituents of the atmosphere that the amount of oxygen in the transpired air rises to forty per cent., and by repeating the process nearly pure oxygen may be obtained.

SECRETION AND EXCRETION.

The functions of secretion and excretion are not mere physical performances, however, but vital processes—combining physical and chemical conditions with vital forces—and consequently exhibit some features quite as inexplicable as life itself. Both filtration and liquid diffusion are observed, but they are modified by the action of living cells. The liquid diffusion of gases involves the passage of a substance through a septum composed of soft colloid matter, or moist membranes, which are impermeable to a gas in the aeriform state. Liquid diffusion may be imparted into the treatment of gases in consequence of the general assumption of liquidity by gases when absorbed by actual liquids or by soft colloids. Water when charged with air holds liquid oxygen and nitrogen in solution; and the latter substances then become amenable to liquid diffusion, and so penetrate animal membranes in the act of respiration.

In natural incubation the eggs are placed in a respirable fluid which surrounds the earth, and forms its atmosphere. This fluid, which is known as the atmospheric air is composed by volume of twenty-one parts of oxygen and seventy-nine of nitrogen. Air also contains 1-2500 volume of carbon dioxid, some aqueous vapor, and small varying amounts of ammonia, nitric acid, ozone and organic matter. Its constituent gases are not chemically united, but are mixed mechanically. It may be spoken of oxygen diluted with nitrogen, the oxygen being the active, and the nitrogen the neutral body. When air is inhaled into the lungs the oxygen is separated from the nitrogen, it unites with the carbon in the blood and is expelled as carbonic acid gas, more properly called carbonic anhydrid or *carbon dioxid;* a gaseous compound of twelve parts by weight of carbon and thirty-two of oxygen. Diffusing inward through the shell, the air reaches the covering membrane of the egg, which, being thin and moist, offers no serious impediment to its passage inward, the transmission is effected with perfect ease. A partial separation, however, is effected, for, whereas atmospheric air consists of twenty-one volumes of oxygen and seventy-nine of nitrogen, air contained in the egg contains about thirty-three per cent. of oxygen.

If an egg be varnished over before incubation commences, and thus exclude the air, there will

be sufficient oxygen already within the shell to suffice for the development of the blastoderm up to about the fifteenth hour of incubation, and the life of the germ is not destroyed until between the twenty-fourth and thirtieth hour, but a fresh supply of oxygen is essential to further development. That is, in order that the nutritious yolk may be afforded to the nutrition of the embryo, it is necessary that it should undergo some changes in which the atmospheric air is concerned, as in the germination of seeds, and during the development of the embryo its blood requires aeration as much as that of the adult animal. In nearly the whole stage of development there is a general or interstitial respiration, or a change essential to life, produced by oxygen in all the substances of the embryo and of its accessory parts, which, as the embryo is more perfectly formed, takes place more actively in particular organs only. As soon as a peculiar nutritive fluid and a central propelling organ are produced, this fluid is exposed on the expanded surface of the yolk to the influence of the oxygen absorbed in the albumen. This blastodermic expansion, or vascular area, throws out villi from its under surface to absorb the yolk, which, in a partially assimilated condition, is transferred to the blood-vessels that ramify over its surface. Thus it acts as the organ of circulation, respiration and nutrition.

As the vascular area rapidly spreads over the yolk, it continues to act as the chief organ of absorption and digestion, but its importance as a respiratory organ gradually diminishes. In its stead a special respiratory and excretory organ is developed in the allantois. The allantois also serves a nutritive function, for by it the denser portion of albumen is ultimately enclosed and absorbed. It is very vascular, and until the last few hours serves as the chief organ of respiration, the oxygen gaining access to it through the coverings of the egg, with which it is in contact.

The passage of carbon dioxid and hot watery vapor out of the blood, and of oxygen into it, is the essence of the respiratory process, and thus a membrane with blood on one side, and oxygen on the other, is all that is absolutely necessary to effect the purification of the blood. Blood holds in solution rather less than half its volume of gases, two-thirds of which is carbon dioxid, less than one-third oxygen, and not one-tenth nitrogen. It contains rather more oxygen gas than could be held in solution by water, not in a free state, but held in some sort of loose chemical combination with a constituent of the blood. The function of the blood is to supply nourishment to and take away waste matters from all parts of the body. It is absolutely essential to the life of every part of the body that it should be in such relation with a current of blood that matters can pass freely from the blood to it, and from it to the blood, by diffusing through the walls of the vessels in which the blood is contained.

VENTILATION A VITAL NECESSITY.

Carbon dioxid is constantly generated in the body, and is, therefore, to a certain extent, one of the natural constituents of the blood; but, when not promptly thrown off, its action becomes quickly injurious. When an egg is covered with an impermeable varnish, or the mutual diffusion of the gases on either side of the shell is in any way sufficiently prevented, what is called asphyxia takes place, and the embryo soon dies. This is caused by lack of oxygen and excess of carbon dioxid in the blood. It is not necessary to close the pores of the shell to bring on asphyxia, but this condition can be effected either wholly or in part by decreasing the proportion of oxygen, or increasing that of the carbon dioxid in the surrounding medium.

The proportion of carbon dioxid naturally existing in the atmosphere may be assumed as inoffensive, but all increase is more or less deleterious. A cubic foot of air of average purity contains a little less than a cubic inch of carbon dioxid. When this amount is increased to eight or ten per cent., the vital activity is sluggish, and when raised to twelve or fifteen per cent. it is speedily destructive to the life of the germ. The cause of this is obvious. Other things being alike, the rapidity of diffusion between two gaseous mixtures depends on the difference of the proportions in which their constituents are mixed; it therefore follows that the more nearly the proportion of carbon dioxid on one side of the membrane approaches that on the other, the slower will be the diffusion of carbon dioxid outward, and of oxygen inward, and the more charged with carbon dioxid and defective in oxygen will the contents of the egg become. And, on increasing the proportion of carbon dioxid in the outer air, a point will at length be reached when the change effected is too slight to relieve the respiratory blood of its carbon dioxid, and to supply it with oxygen to the extent required for its aeration.

Thus we can appreciate the vital necessity of ventilation, or the purification of the air surrounding the egg; which is essentially the dissipation of the carbon dioxid exhaled, and the replenishing of the oxygen consumed. The purification

of the general atmosphere is maintained by various agencies of nature. By the law of diffusion all gases intermingle, so that where impurities are set free at any point they tend to diffuse away, and thus become weakened or lost in the great body of the atmosphere. The mixture of large masses of air and the dispersion and dilution of local impurities are also affected by the winds. Gaseous exhalations are washed out and absorbed from the atmosphere by the fall of rains. The earth's vegetation absorbs and consumes carbon dioxid, while the oxygen is set free. The oxygen of the air slowly burns up the numberless combustible vapors and contaminations which are thrown into it. By these means the earth's atmosphere is constantly maintained respirable and pure.

A CURRENT OF AIR UNDESIRABLE.

As has been shown, in natural incubation a spontaneous intermixture or diffusion of the gases takes place through the coverings of down and feathers, though they are sufficiently dense that any current in an outward and inward direction is prevented by frictional resistance. The latter aids in keeping in the warmth, and also in the rotting of the shell. That is, the carbonate of lime, of which the shell is composed, absorbs moisture. Carbonate of lime, however, is altogether insoluble in pure water, while water saturated with carbon dioxid dissolves 1-1500 part. Water under ordinary circumstances absorbs rather more than an equal volume of carbon dioxid. For its own temperature, the exhaled carbon dioxid is saturated with aqueous vapor; a part of both being condensed by the shell. Thus the ovum itself furnishes the means for the disintegration of the particles of the shell—the carbon dioxid rendering the carbonate of lime soluble in the water or moisture, which is always present. Although a free exposure of the egg to the atmosphere is indispensable to the development of the embryo, yet a current of air is exceedingly undesirable; as the rapid circulation of the atmosphere would be attended with the quick dissipation of the moisture and carbon dioxid.

THE RELATIVE HUMIDITY.

The rapid movement of the air around the eggs has yet other and equally deleterious effects, but they all, however, involve the same principle, *i. e.*: the dryer the air, and the more it is agitated, so as to bring fresh currents in contact with the moist surface, the more rapidly does evaporation take place. The effect of warmth is also to hasten evaporation, but a high degree of heat is not essential to it. At ordinary temperatures, wherever a moist surface is in contact with the air, vapor is formed. This process is called spontaneous evaporation. Aqueous vapor is always present as a minor constituent of the atmosphere, and its amount, which is very variable both at different places on the earth's surface and in the same locality at different times, forms an important element of climate. The process of evaporation is constantly going on at the surface of the earth, but principally at the surface of the sea and other bodies of water.

The amount of vapor which can exist in the air is limited, and depends upon its temperature. It is therefore evident that if the air be saturated with moisture, no more can be vaporized; and that, in proportion as it approaches saturation, must the process of evaporation be retarded. Whereas, if the air contain but little vapor it can readily take up a large additional amount, and the process of evaporation must be proportionally hastened. In dry, cold days in winter, the evaporation is exceedingly rapid; whereas, if the air contain much moisture, it proceeds very slowly, even though the air be warm. In other words, space has a capacity for vapor depending upon its temperature, so that if there is a given definite amount or weight of vapor in the air at a certain temperature, the relation which this vapor bears to the whole vapor-carrying capacity of the air at that temperature is very different from the relation which the same amount of vapor bears to the carrying capacity of the air at another temperature. This relation is commonly called the *relative humidity*. Air of a given temperature becomes saturated when there is a certain amount of vapor present, and it can be made to take up no more unless its temperature be raised. Any surplus vapor must be condensed. This vapor present in the atmosphere has, as a gas, a certain pressure, tension, or force, whichever term we care to use to express the same thing; and this tension may be as great or greater at the freezing point of water, than during ordinary summer temperatures, as the atmospheric air is seldom completely saturated when its temperature is high.

All air found in a natural condition contains more or less of this gas which we call vapor, though it is seldom in a state of complete saturation. Even the dry air blowing over a heated desert contains a small amount, and it is this amount which largely influences the rapidity of evaporation.

In natural incubation the eggs are surrounded

by a mass of warm air, held entangled and separated from the outside atmosphere by a porous septum of down and feathers, which allow of a reciprocatory movement, or free interchange of the constituent gases and vapors of the inner and outer atmosphere. In other words, the air immediately in contact with the incubating body and eggs becomes warmed. In the gain of heat it expands, becomes lighter, or of a lesser specific gravity than the outside colder and denser air, and tends to flow outward into the latter, which replaces it. It does not, however, carry all its increased warmth with it. That is, in passing outward, its molecules come in contact with those of the incoming colder air, and imparts to them a portion of its own greater warmth. This loss of heat by the outgoing, and gain by the incoming air, does not quite equalize their warmth within the walls of the septum, under ordinary conditions, but the incoming air gradually gains heat until it comes into direct contact with the heating body, when it has reached its maximum temperature, and then, flowing outwards, loses heat until its remaining warmth is finally dissipated in the surrounding atmosphere. Thus it is seen that the loss of heat is reduced to the minimum, notwithstanding the fact that the atmospheric air surrounding the eggs is being continually changed. The carbon dioxid and organic matter thrown off by the incubating body and eggs, also, as it gains in tension, gradually diffuses outward, being replaced by pure respirable air.

Again, as it has been shown that the porous septum offers no serious obstruction to the interchange of gases and vapors, it will be seen that the relative humidity or tension of the aqueous vapor in the two atmospheres must be essentially the same, regardless of the difference in temperatures. That is, the quantity of aqueous vapor held in suspension by the outside colder air is as great for its own temperature as the quantity held in suspension by the inner warmer air, and therefore the tension of the aqueous vapor is as great in one atmosphere as in the other. Either an increase or loss in one is immediately felt by the other, and a corresponding movement from the greater to the lesser immediately sets in, and tends to restore their equilibrium. Aqueous vapor will diffuse neither outward nor inward when it exists in the same proportion in both atmospheres, but dry carbon dioxid only will be exchanged for dry air, in the proportion of their equivalent diffusion volumes. The incubating body and eggs, however, are continually throwing off watery vapor, which, increasing the tension of the vapor in the inner air above the tension of the vapor in the outer atmosphere, causes a slow diffusion outward, the movement tending to keep up the equilibrium.

Thus the relative humidity of the two atmospheres is always essentially the same, whether the hen nests in a meadow on moist ground, and surrounded by a moist atmosphere, or in a hayloft and surrounded by dry air. And as she brings out equally as large a proportion of chicks in one place as the other, it is obvious that ordinary changes in the degree of humidity of the atmospheric air have no serious ill effect on the incubation of an egg. And while nature is equally kind in this respect, wherever the hen has found a home, whether she nests in the wild Bengal jungle or in the northern farmer's barn, the artificial hen has required a varying quantity of supplied humidity, and has received the curses of an exasperated host. It is equally as obvious, then, that in building these artificial hens, commonly called incubators, or hatching machines, that we have transgressed some law of nature, and created an abnormity which we have been vainly trying to alleviate. The cause of this abnormity is not far to seek.

A DRYING PROCESS.

We have seen that in natural incubation there is a reciprocatory movement, or free interchange of the constituent gases or vapors of the inner and outer atmosphere, through the intervening septum of down and feathers, which keeps the inner air respirably pure, and tends to maintain the relative humidity of the two atmospheres. On the other hand, in artificial incubation the colder outer air, passing inwards *en masse* through one or more wide apertures in the solid wall of the egg chamber, creates a current sufficient to carry along with it whatever vapors with which it may be charged. Mingling with the inner warmer atmosphere, and coming in contact with the heating surfaces, it gains in temperature, which directly increases its capacity for taking up moisture. Reaching its maximum temperature, it eventually passes outward, still *en masse*, through the apertures, which again creates a current sufficient to carry along with it its vapors, with any additional gases or vapors it may have gained during its stay in the incubating chamber, and is dissipated in the surrounding atmosphere. This process is continuous, and is kept up as long as the apertures remain open, and the exchange between the two atmospheres is effected in the same

manner, that is, by a continuous inward and outward current, whether there is but one or a number of apertures, the only difference being in degree or rapidity of the change, depending upon the area and location of the opening, and the temperature of the surrounding atmosphere. In some machines the activity of exchange between the two atmospheres has been reduced to the lowest point, but with a corresponding loss in the purity of the air within the egg chamber.

The immediate effect of ventilating the chamber in which the eggs are placed by means of more or less wide openings in its walls, is to increase the capacity of the incoming air to take up moisture by raising its temperature, without providing to any appreciable extent for the absorption of moisture from the exterior atmosphere, and also the dispersion or carrying away of any moisture gained from the eggs placed within the chamber. Thus it is seen that the air around the eggs is in a comparatively dry state, there being a wide difference between its degree of humidity and its total capacity for moisture at its temperature. This state of the air stimulates vaporization, and causes an excessive evaporation of the watery portion of the egg. The egg originally contains about 74 per cent. water, but nearly all of this large amount is as essential to the development of the embryo as the solids, for water is a very large constituent of all parts of the body. The bones contain 130 parts of it in 1,000; the muscle, 750; the blood, 795; and it forms, in fact, nearly three fourths of its entire weight. It is evident, therefore, that if the supply of water is diminished by excessive transudation and evaporation the development of the embryo cannot go on.

The rest or movement of the air is of more importance than the difference in the tension or degree of humidity, as influencing the rate of evaporation; for it is found that evaporation is much slower in still air than in a current, with the same degree of humidity. The air immediately in contact with the moist surface becomes saturated with vapor, and a check is soon put to evaporation; if, however, the air be quickly removed as fast as it becomes charged with vapor, and its place supplied with fresh, dry air, the evaporation continues with undiminished rapidity. It is the protection from any current of air that largely prevents a rapid evaporation from the eggs in natural incubation, the diffusion of air and vapor around the eggs being a slow process of exchange in comparison with a current of air.

As incubation progresses there is a special respiratory organ developed, called the allantois, which eventually encloses the whole contents of the egg, and the exhalation of moisture then becomes a vital process. Yet the rest or movement of the air influences the amount of evaporation, even after it ceases to be merely a physical process; for we find that when a frog is placed in the draft of an open window it will lose triple, or even quadruple the amount exhaled by others placed at a closed window in the same room. It is during the last stages of incubation, and after the exhalation of moisture becomes a vital process, that the rapid evaporation from the surface of the egg, excited by a current of dry air, does the most harm, and which many times ends in the death of the embryo. The cause of the fatal effect of the rapid evaporation is to be found in the drying of the enclosing membranes of the egg; or, in other words, the membrane covering the ovum becomes too dry to take up enough oxygen to suffice for the development and vital activity of the embryo. While moist animal membranes allow the exchange of carbon dioxid and oxygen to be effected with perfect ease, offering no serious impediment to the passage of either gas, dry animal membranes are impermeable to gases.

Although the drying of the covering membranes often cuts short the development of the embryo, and the germs die at various stages of incubation, more generally the embryo suffers the most from this cause from the seventeenth day to exclusion, the greatest number dying about the eighteenth or nineteenth day. By the seventeenth day the albumen is about all absorbed, and the yolk is decreasing in size, and is less fluid. The chick is breathing by means of the allantois, which entirely surrounds it and which is in close proximity to the shell and surrounding atmosphere. As the amniotic water in which the embryo has been immersed is reabsorbed, the sac in which it was contained fills with air, and the chick drawing this air into the lungs, the pulmonary respiration is gradually established. As the pulmonary circulation increases in activity, the circulation of blood in the allantois gradually diminishes, and the allantoic fluid eventually disappears, so that by the end of the nineteenth day the only moisture of any consequence left within the egg is that contained in the substance of the yolk and embryonic structure. There is a nice timing, however, in the loss of fluid by the allantois, for it does not normally entirely disappear until within a few hours

of the rupture of its coverings by the chick, the membranes remaining moist for some time after, and do not become dry until the chick has been breathing the surrounding air direct for several hours. This is the critical period, for if evaporation be too rapid the allantoic fluid is too early dissipated, and the allantois then is dependent upon the embryo for its supply of moisture necessary to its function as a respiratory organ, and, should the rapid evaporation continue, its membranes very soon become too dry to take up enough oxygen to suffice for the needs of the organism, and death supervenes.

On the other hand, while unduly hastening the drying of the allantois, by excessive evaporation is fatal to the life of the chick, an excess of moisture present in the surrounding atmosphere is equally as deleterious, although in the opposite direction ; that is, in the prolongation of its functional activity. In other words, by the time the embryo is sufficiently ripe to rupture its coverings the circulation of blood in the allantois is normally quite sluggish, and as soon as the chick gains access to the surrounding air the allantoic circulation ceases, and its membranes become dry. But, should the air be overcharged with moisture, the allantois and blood gains fluid by absorption, and the allantois remains functionally active. Continuing to absorb moisture, the chick eventually gains an excess of water sufficient to interfere with the vital functions.

FOUR PHYSICAL FORCES.

It will now be seen that, other conditions being equal, the degree of humidity ordinarily existing in the atmospheric air is sufficient for successful incubation, providing that the tension of the moisture in the two atmospheres remains the same, and that the rate of movement of the air surrounding the eggs exercises a more powerful influence on evaporation than the usual variations of humidity. In the construction of our hatching chamber, therefore, there are four features of vital importance to be considered, viz.: a non-conducting wall that will protect the eggs from outward changes of temperature ; a provision for maintaining the atmospheric air within the chamber in a pure state ; the maintenance of as great a tension of aqueous vapor in the inner as in the outer atmosphere for their respective temperatures, and the control of the movement of the air around the eggs.

In natural incubation the purity of the air surrounding the eggs is maintained by exchanges with the outer atmosphere through the wall or septum that intervenes. This wall is composed of down and feathers, which allow of a spontaneous diffusion of gases or vapors through them, while they are sufficiently dense to hold any current in check by frictional resistance. It is therefore obvious that the natural provision for maintaining the purity of the air around the eggs also provides, through the same medium, for the retention of warmth, for an equilibrium between the relative humidity of the two atmospheres, and for the control of the movement of the inner air. And as it is the nature of the fabric of which the wall is constructed that controls the physical forces of incubation, that is, the storage of warmth, and the purity, humidity and movement of the air surrounding the eggs, it is evident that we have not appreciated, or even understood its function.

Knowing the physical forces which this porous septum of down and feathers controlled, and the influences which these forces exerted over the embryonic development, I realized the importance of having the walls of the hatching chamber, which represents the wall of down and feathers, constructed of a similar fabric, or at least of a material which would control the same physical forces. With this end in view I have experimented with many porous fabrics, from a septum with a density of a loose carded wool to a plaster slab, and of various thicknesses, and from a square foot to the entire wall of the hatching chamber composed of these substances.

I have experimented in every section of the Union, under the varied conditions of temperature and moisture, and with several arrangements of porous hatching chambers. The system which was found to be the most practical was finally employed in the manufacture of the Cyphers. These porous diaphragms form the upper and lower division of the chamber, and through them the air has to pass in entering and leaving the apartment where the eggs are placed.

The fresh warm air is first distributed evenly over the whole area of the upper diaphragm before entering the egg chamber, and after diffusing through the minute pores the air is gradually drawn down around the eggs through the chamber in a slow but positive manner. It is there diffused through a double porous diaphragm placed above a shallow chamber in the bottom, from where it is drawn out into the heater, carrying with it the poisonous gases thrown off by the eggs, and is dissipated in the outer air. This method gives a larger volume of pure air than is usually employed, and that without the drying effect of profuse direct ventilation. The heater is ar-

ranged in such a manner that the fresh air gains moisture as it gains warmth, and by the time it enters the egg chamber its relative humidity is equal to that of the outer air. Thus, in the Cyphers the tension of the moisture around the eggs is always equal to that out of doors, as is the case with the hen incubating. The upper and lower diaphragms keep the air from entering and leaving at one point, but diffuse it over the entire area of the chamber; while the drawing power of the heater keeps its movement downward positive, though slow. The eggs are never dried down too much, though they are supplied with abundance of fresh air, enabling us to run hatches under all conditions without the use of supplied moisture. Under this system we are also enabled to get stronger and more healthy chicks that make a better live of it. This is a rapid stride toward absolute success in artificial hatching, and not only does it ease the work of the beginner, but the old and experienced incubator operator appreciates it, because it solves for him a perplexing and heretofore uncertain problem in the science of incubation. This small principle took years of study and experimenting to develop into the practical institution which is to-day in the Cyphers Incubator, and is possessed by no other machine on the market.

As the embryonic development is a continuous process, and a large amount of liquid is necessary at all times for the needs of the vital economy, it is obvious that the liquid present should be ample, and the quantity originally contained in the egg should not be dissipated by excessive evaporation. Where the atmosphere in which the eggs are placed is not too dry, and its movement be not too rapid, the embryonic structures absorb from the contents of the egg, and retain within their membranes until the last all the liquid they require for their normal activity.

PROMINENT BREEDERS SAY:

No worrying over evaporating eggs or supplying moisture, as your system of ventilation takes care of that.

KLEPPINGER BROS.

Freemansburg, Pa.

It is a great relief to my mind to have the moisture question settled by not having to use any.

WM. H. TRUSLOW.

Stroudsburg, Pa.

Your system of ventilation which preserves moisture solves one of the difficult problems of artificial incubation.

HORACE G. HUEY.

Woodbury, N. J.

The fact that the ventilation is perfect, coupled to the even temperature which the regulator maintains, and that there is no bother with moisture, is, in my opinion, almost perfection in artificial incubation. I got more chickens out of your 360 egg machine than I ever did out of a 600 egg----------, and such strong, lively chicks, it did my heart good.

C. BRICAULT, M.D.V.

Lawrence, Mass.

I made a hatch of 61 ducks, 21 turkeys, 16 guineas and 24 chicks in one machine, hatching every fertile egg but three duck eggs.

WM. H. JONES.

Lincoln University, Pa.

Incubator received from you has done excellent work, hatching larger per cents. than any other make yet tested, and chicks all healthy and smart. You have a good incubator in The Cyphers, and I can truthfully recommend it to any person contemplating the purchase of an incubator. What pleases me most is that it does away with all guess-work in applying moisture, as no moisture is required, owing to proper ventilation.

C. G. JARVIS, Mgr. Poultry Dept.
Ontario Agricultural College.

WHAT THE MACHINES ARE MADE OF.

Probably no machine on the market is so expensive to build as the Cyphers. Only the finest material is used, and the most skilled workmen available are employed in its construction. In many machines fine finish on the outer case covers a multitude of sins on the inside. In the Cyphers more pains, if anything, are employed on its inner construction, because it is built to hatch, and not merely to show, though the outside case is both neat and attractive.

The top, bottom and sides of the outer case are made of thoroughly kiln-dried white pine, mortised, stub-tenoned, glued and screwed together. White pine makes the best possible case, but is much more expensive than the woods usually employed for this purpose. The additional cost, however, is offset by the enhanced value to the purchaser. The door is double glass, and all machines are finished in umber-tinted cherry, shellacked and varnished, and are not excelled in either durability or attractiveness.

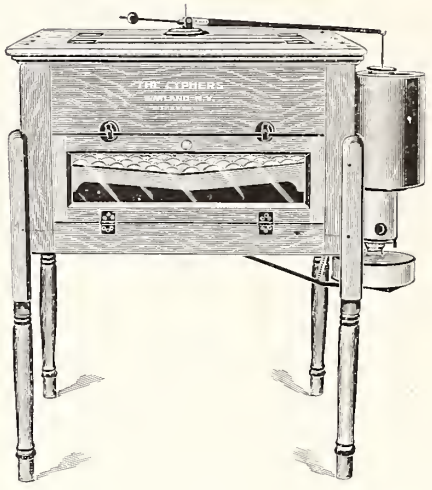
THE TRAYS.

The trays used in the Cyphers combine lightness and strength, two very important factors to be considered in an incubator. They are constructed of the best galvanized wire-cloth bottoms, which will outwear any of the cheap fly-netting usually employed for this purpose. There is a space at the end of the trays for chicks to drop down into the NURSERY beneath. This gets them out of the way of those not yet out of the shells, and obviates the necessity of opening the door in cold weather to take out the dry chicks, which has been the means of chilling and killing thousands of young chicks. The door need not be opened until the entire hatch is off.

THE HEATER.

The heater is made of the best galvanized iron, covered in with a jacket of asbestos, which forms a perfect protection. The *lamp fumes do not pass into the machine at all*, but up the inside and down around the outside of the fresh-air chamber in the heater. Where the lamp fumes pass through small flues into an iron heater in the machine proper, there is always a liability of their becoming choked with soot, when the machine will no longer heat evenly. There are many machines to-day in this fix that are practically worthless for further use, they varying from four to six degrees in one tray.

In the Cyphers the pure warm air alone flows into the heating chamber above, is evenly diffused over and through a porous diaphragm and into the hatching chamber. It is then carried downward around the eggs and through a double porous diaphragm placed above a shallow cham-



No. 1

ber in the bottom, from where it passes out into the heater, carrying with it the poisonous gases thrown off by the eggs, and is diffused in the outer air.

The fresh warm air is distributed evenly *over the whole area* of the hatching chamber *before entering*, and, after diffusing through the minute pores of the upper diaphragm, the downward movement through the egg chamber is *slow* but *positive*, and gives a larger volume of pure air than is usually employed, and that without the drying effect of profuse direct ventilation.

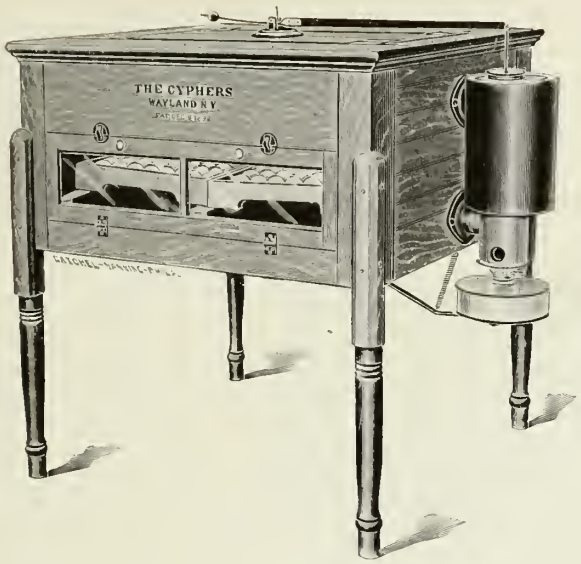
This is a distinct advance on the old system of heating and ventilating, and, combined with a regulator that holds the temperature, not within several degrees and called even, *but to a fraction of a degree for an entire hatch*, makes it a *perfect incubator*. This is positively the only machine that will run in warm and changeable weather without constant attention, and will be especially appreciated by those hatching chickens or ducks in the late Spring and Summer, when the windows must be thrown open. With this incubator there are no slips and no failures, simply because the machine does the work, and not the operator; and the beginner may expect and will secure good hatches without experience, and the old operator better general averages with less trouble.

THE NURSERY.

The nursery is situated below the egg-trays, and is one of the most useful features of the machine. It is large and roomy, and is of inestimable value in bringing out a large hatch. As soon as the chicks or ducklings get clear of their shells, they move forward toward the light and drop down naturally to the nursery below. The soft diaphragm below prevents any danger of injury from the short drop. By thus disposing of the hatched chicks, those not yet clear of the shell are not annoyed and are left to work out their salvation in their own way.

THERMOMETERS.

We furnish a high-grade thermometer with each machine, especially designed and manufactured for the Cyphers. These thermometers are all two-year old tubes, have been chosen after long and severe tests, and are the best ever put upon the market by any manufacturer of incubators. They are subjected to several tests before being sent out.



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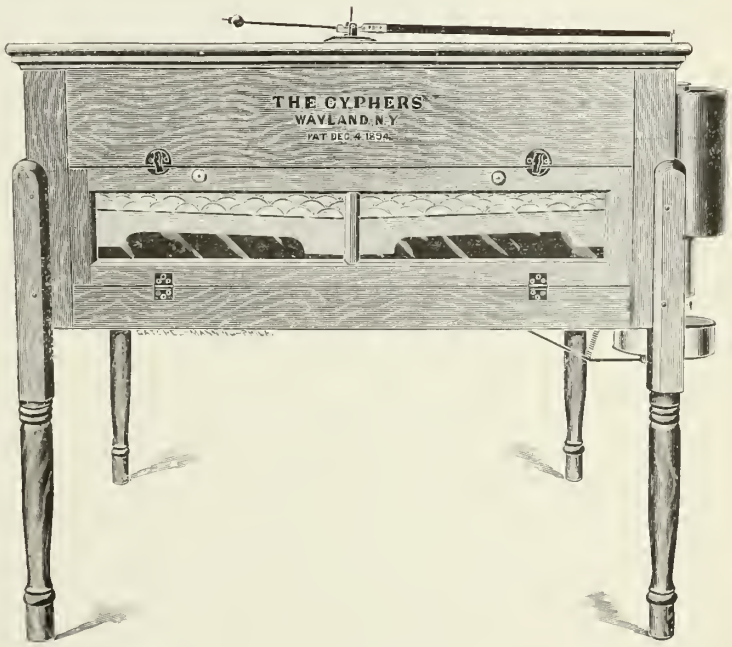

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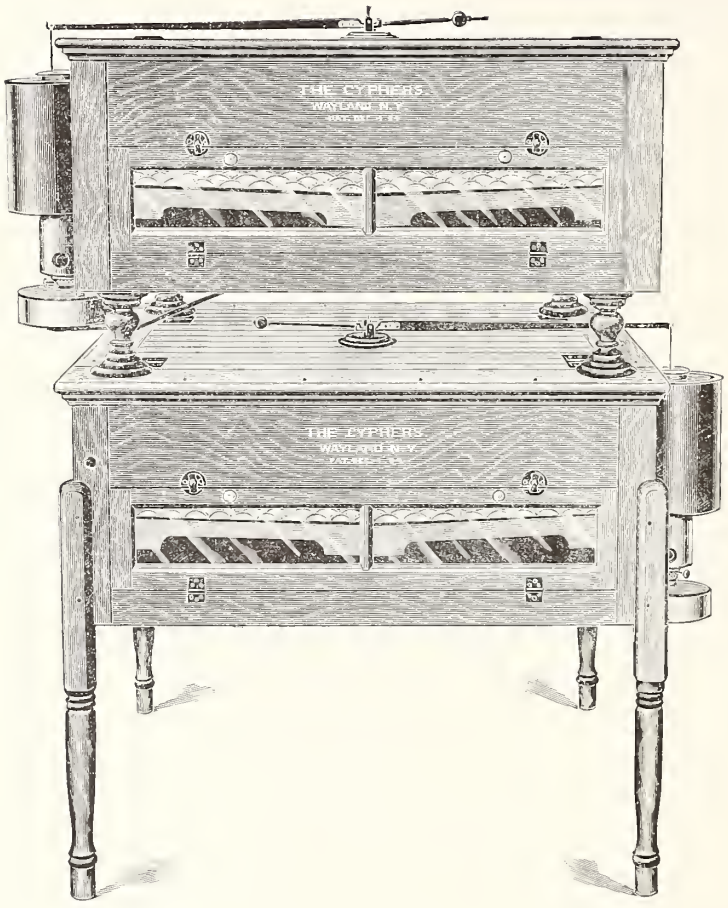


DOUBLE-DECKER.

PRICES AND TERMS.

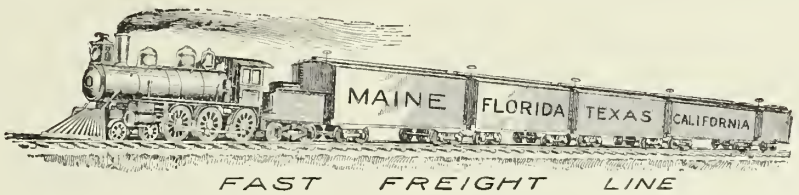
INCUBATORS.

	Price.	Disc. p. c.	Net.
No. 1, 120 Hen Eggs, 100 Duck Eggs	$20	10	$18 00
" 2, 220 " 190 "	29	10	26 10
" 3, 360 " 290 "	37	10	33 30
" 3, Double-decker	74	10	66 60
" 2, " "	58	10	52 20

WEIGHTS (ABOUT) CRATED.

No. 1	125 lbs.
" 2	185 "
" 3	210 "

WE PAY THE FREIGHT TO YOUR STATION AND SHIP VIA A



Cash should in every instance accompany the order and may be sent by certified check, post-office or express money order or New York draft.

When considering the price on the Cyphers, it must be remembered that it is the most expensive machine on the market to manufacture, owing to the high grade of lumber used in its construction. Still, it is much lower in price than many other standard makes. The price was made low, as it was not the intention to give large discounts to agents, as others do, and make all our customers pay an exorbitant amount in order to please a few who desired agencies. It has been found desirable in a few instances to allow a small commission to those who ran a large number of our machines, dividing our small profits with them; but this very small commission has not been attractive to many who desired to make out of every one they came in contact with, and they preferred to recommend and sell a less worthy machine on account of the greater gain to themselves. It was the desire at the start to have no agencies, but to pay freight, so as to place all our customers on an equal footing. Our margin of profit was so small that it was found impossible to do this up to this season. In May the business was moved to Wayland, where a large, roomy factory was erected. A good many thousand dollars was spent on improved machinery that would save greatly on labor. Sufficient capital was put into the business to warrant our buying our lumber by the cargo, at first cost; and our supplies, such as nails, packing, etc., by the carload. Also to discount our bills and save in every possible manner. By doing this we are now enabled to accomplish the long-cherished desire of *paying freight* to every part of the United States, so that now when a customer sends us the price of an incubator, it is all it will cost him laid down at his nearest freight station. In doing this, we have made all the concession our small profit will warrant, so we cannot cut the price for any one.

OUR GUARANTEE.

We guarantee that, *where the Cyphers Incubator is run with another of different make, it shall, in three or more hatches, bring out a larger average percentage of the fertile eggs in good, healthy chicks or ducklings than does its competitor.* The only condition exacted to make this guarantee valid, is that we shall be advised from hatch to hatch regarding the results, and conditions under which the machine is run when so requested, so that, should further directions be necessary to insure complete success in any location, they may be given in season.

WHAT SIZES TO BUY.

The No. 3 Cyphers is the practical business machine that all the leading breeders are using. It will hold from 360 to 400 eggs and is a model of usefulness and finish. The regulation and all other working parts are identical in the different sizes we make—of course being proportioned to the size of the machine. Other manufacturers find difficulty in getting their large machines to run evenly and do the same work that smaller machines do. Our No. 3 does its work correctly, however, and, once regulated to the proper temperature, stays there and hatches the same large percentage that our smaller machines do.

The No. 2 holds 220 eggs and is a very desirable machine in every way. The large breeders use it to fill in spaces in their cellars where room is limited, and also as a tender for the big No. 3 machines as eggs are tested out. It is most desirable for the fancier.

The No. 1, holding ten dozen, is the best hatcher of its size in the world. It is simply a little marvel, and is so expensively built that other manufacturers have given up all attempts to compete with it.

The double-deckers are made up of two No. 2's or two No. 3's, as the case may be. They are of great value where room is limited. The double-deckers are double the capacity and price of either the single No. 2 or No. 3, and are made in rights and lefts so that neither heater interferes with the working of the other machine. Both will run as true and give the same results as do the single machines.

TURNING THE EGGS.

The eggs should be turned twice a day up to the nineteenth day. If this is not done many of the germs will dry fast to the shell during the early stages, owing to the influence of a high temperature, and the breaking up of the arrangement of the albumen, which then allows the germ to be pressed upward with some force. Then again, during the initial stages of development, the germ gets its oxygen from the albumen. In fact, it gets its supply of oxygen from this source until the allantois attains some considerable size, the vessels in the vascular area absorbing the oxygen from the albumen, in the same manner as the blood-vessels in the gills of a fish absorb the oxygen from the water in which it lives. Turning the egg brings a fresh surface of albumen in contact with the shell, thereby causing a more rapid absorption of oxygen from without, and also brings a fresh surface of albumen in contact with the vascular area. When the egg is not turned during the later stages of incubation, the embryo does not attain a natural position, and has little chance of being excluded.

OUR METHOD OF TURNING.

In the Cyphers we prefer to turn the eggs by hand, because it is possible to secure better hatches in any machine by so doing. In using an automatic shifting device, the eggs are all left in one location in the machine, as is also the case when using an extra tray. There has never been a small machine made, and there never will be one that holds more than two or three dozen eggs, that does not vary from 1° to 1½° in the extreme parts of the hatching chamber. It is a well-known fact among old operators that if the eggs are left in one position in the machine, some of the eggs suffer for it. Old operators using an extra tray for turning the eggs, always shift the trays about in the machine, turning them from end to end, and from side to side, so as to even up the inequality of temperature in different parts of the chamber. We not only prefer to shift the trays from side to side and end to end, but also to shift the position of the eggs in the tray, believing that thereby the average hatch is increased 5 per cent., as it also shifts the location of the eggs in relation to weak germs or unfertile eggs.

In designing the Cyphers every factor known to artificial incubation has been taken advantage of to secure every chick that it is possible to coax from the shell. Many beginners think it is necessary to turn every egg just half over morning and night, which is not necessary. It is far more important that the eggs should be shifted about, as long as on the average they turn a half revolution or more in the two turnings.

In the Cyphers the trays are made sloping to the centre to facilitate turning and to even up the heat. Not only do the bottoms of the trays slope

toward the centre of the tray, but the trays themselves are so placed that they slope toward the centre of the machine when in position. For reasons brought forward in the chapter on heating, the centre of the machine is the warmest, and the four corners the coolest. To even up this inequality the trays are sloped in the above manner, so that the eggs in the dead centre of the chamber are lower than those at the four corners, and in this manner the heat is evened up so that there is less variation in the egg chamber of the Cyphers than in any other machine on the market.

In turning the eggs the two rows next the middle partition of the tray, which is the lowest point, are taken up and placed in the ends, which is the highest point, and the intermediate eggs allowed to roll down. In this manner the position of the eggs in the trays is being continually changed, and better results secured. It takes no longer to turn 360 eggs in this manner than with an extra tray, while it is next to impossible for a woman to turn a long tray of eggs by placing an empty one on top and turning them over. Where operators have to turn the eggs in a number of machines the extra tray system becomes a back-breaking job. We claim for our method that it is done as quickly as with the extra tray, is far less laborious, cracks less eggs, and gives better hatches than where the extra tray or automatic system is used.

PLACING THE INCUBATOR.

Before a hatch is started, it is very important that the machine be placed in an apartment which has a normal atmosphere, and protected from rapid and extreme outer thermal changes. By a normal atmosphere, I refer to an atmosphere as ordinarily found out of doors. In other words, the air should be fairly pure, and contain a moderate amount of moisture. In a wet cellar, for instance, which contains rotten wood, decaying vegetables, etc., we would not call the air normal, for, upon examination, it would be found to contain a high degree of humidity, and too large a percentage of carbon dioxid and poisonous organic matter.

While a chamber partially underground like a cellar is one of the best places to put a machine, it should be dry, clean and sweet, with some ventilation. In cold weather, where there are two or three windows in the apartment, no direct openings will be needed, as more or less air will find its way in between the fittings as ordinarily made. In moderate and warm weather there will need to be direct ventilation. The *smell* of the apartment is a good indication as to whether it needs more light and air or not.

One advantage of an underground room is that it does not quickly feel the extreme temperatures in the outside general atmosphere. The temperature of a well-insulated cellar will never fall to the freezing point, and will seldom rise to 80°, while the thermal changes are slow in taking place. The main advantage is, however, when hatching in the early fall or late spring, a room like a cellar, with stone or brick walls, keeps the air cool.

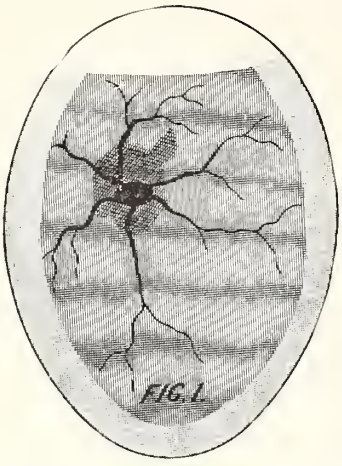
For some reasons we prefer it, but experience has proved that a large percentage of the house cellars are too damp for the best work, and we, therefore, have advised placing the incubator above ground. Many of our customers run their machines in good cellars, and many more in the sitting room, or a spare bed room. That is, with two 8-inch courses of brick, with a 4 inch air space between.

If we were to build an extra fine room we should make a half cellar, and construct the walls so as to have an air space.

Many build cellars late in the fall, and they are very wet and ill-ventilated the first season, and if of stone in wet ground, they never dry out, and hatches are apt to run poor. We know of one large breeder who spoiled a whole season by moving into a green cellar. Our experimental room is a ground floor, 12 x 16, into which we crowd six No. 3 double-deckers, or 12 360-egg machines. On account of the heat in the late spring and summer, however, we would prefer a half cellar, with double walls to keep it dry and cool. There is hardly any limit to where the Cyphers can be run successfully. One of our customers started in duck breeding last season on a very small capital. He had over 200 breeders saved over, and only money enough to build a 40 foot brooder, and pipe over one side of it. Having no incubator house, the machines went in the blank side of the brooder house. The machines hatched so well, and the ducklings came so fast that he only had room for them on the heater side for ten days, when he ran them down the other side underneath the incubators for ten days, and then into all kinds of makeshifts out of doors. When we visited the plant the season was a little more than half over, and there were at that time upwards of 5,000 ducklings out, quartered in about as jumbled and cheap a manner as one could well imagine. Thus we put no limit to where the machines will run successfully.

TESTING THE EGGS.

The eggs should be tested the fifth or sixth day, and the unfertile eggs and dead germs thrown out. *Fig. 1* shows a fertile egg, *Fig. 2*, a dead germ, and *Fig. 3*, an unfertile egg. A

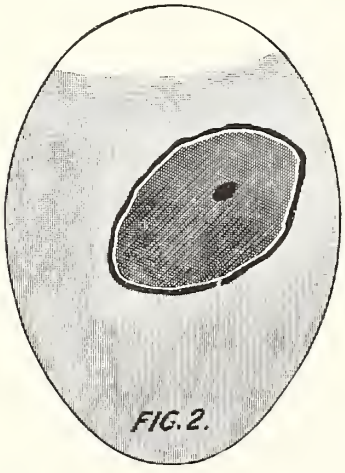


little practice will enable the novice to detect the fertile eggs with readiness.

We usually test hen eggs on the sixth and fourteenth days; duck eggs on the third, twelfth and eighteenth.

TAKING OFF A HATCH.

In cold weather it is seldom necessary to open the machine before the chicks are well dried off. With a large hatch coming off on a warm day, it

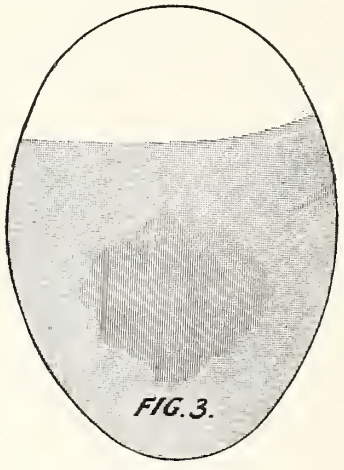


is well to open up when about two-thirds over, and remove as quickly as possible those of the dryest that can be reached handily without taking out the trays. Confining 200 to 300 chicks in a small space for a long time does them no good, yet they do not want to be removed too soon. Where a nursery is supplied below the trays, it is seldom necessary to open a machine. Where a very large hatch is about over in the afternoon, we would not leave them all in over night, or we should expect to find some of them trampled in the morning. The operator will have to be guided here by his best judgment, and should remember that it is better to err on the side of lateness rather than haste.

In moving the chicks from the incubator to the brooder during cold weather, use a warm-lined basket or box, as the chicks are at this time very easily chilled. A chill means bowel trouble, and bowel trouble in a very young chicken, short life.

THE BROODER.

If we have properly selected, housed and fed our laying stock, and hatched the eggs in a machine correctly designed, we should have as fine a lot of chicks as one would care to see—



strong and active. It is the active chicks that make a live of it.

In selecting a brooder, we prefer one that can be kept warm without a hover. A small closed hover is apt to steam the chickens up, and they crowd under it too much. The brooder temperature should be kept at 90° for the first twenty-four hours, and then reduced 1° a day, regularly for three weeks. If this is done the chicks will not feather so rapidly, and will be much stronger and make a better live of it than if kept at a high temperature.

We prefer to use indoor individual brooders for the first three weeks, placing them in an end of a long brooder house, the temperature of which we keep at 70°. After the chicks are three

weeks old they are taken from the small brooders and placed in regular runs, with a hover without heat for nights, the temperature of the building being kept at 70° by hot-water pipes along the two sides. This is the most successful plan for raising chickens in large numbers.

The key to success in broiler raising is in never letting the young chicks get chilled and in gradually hardening them off. The brooder house as well as the small brooders should be well ventilated.

If the chicks were hatched from good eggs by a machine constructed on correct principles and placed in a properly constructed brooder, any rational feed will raise them. Cracked wheat is a very good feed for the first month. They should be fed but little at a time, and about every two hours. Dry bread moistened with milk is very good, but never feed sloppy food. Never leave a lot of soft food before them to sour, and feed no more than they will eat up clean.

Water should be before them from the first. Milk to drink is excellent.

After they are a month old, if they have not been overfed, chilled or overheated, they will be ready for forcing, and will stand very concentrated foods, the composition of which can be regulated by the price of waste mill products and grain in each section. The grain can be coarser, and the soft food contain a greater variety of ground grains. Always add a little salt and pepper. Grit of some kind should always be before them. Charcoal is also good. Keep the drinking dishes clean and have them so arranged that the chicks cannot wet themselves, as dampness is fatal.

Lack of grit causes the chickens to become crop-bound or to have bowel trouble. Unclean water, lack of green food, a number of broods running over the same ground during the entire season, without the soil being turned over, if confined in small yards, and lack of exercise, are all likely to cause disease. Both chilling and overheating naturally retard their growth, and cause bowel trouble.

If trees are not at hand, arrange shelter by forming a roof, resting on four posts, having it sloped slightly to the south and raised about 2 feet above ground.

One of the quickest growing natural shades is to make a skeleton frame four or five feet long, and the ends and top covered with three-inch-mesh wire netting and two hop vines planted at each end. If planted early in the spring, they will mat over thickly before the sun gets high.

THE CYPHERS MAMMOTH INCUBATOR.

We give herewith an outside and inside view of the mammoth incubator erected on Mr. Truslow's plant three years ago. There have been many stories written regarding this mammoth invention, of its eventual success or failure, etc., but none quite true to life. In this connection it may be interesting to the reader to have a review of the work leading up to the Mammoth, and the origin of the Cyphers Incubator.

THE ORIGIN OF THE CYPHERS INCUBATOR.

The origin of the Cyphers Incubator dates back some five years, and the experimental work leading up to it, six years further back. In 1887 Mr. Charles A. Cyphers became interested in artificial incubation, and finding the art in a crudely developed state, made a study of the subject, devoting nearly his entire time to it thereafter, besides expending something like $5,000 in experimental apparatus. The history of the art was traced back for several thousand years, and the Egyptian and Chinese methods studied, as well as the habits of the different species of mound birds, and others which do not incubate. All the English experiments from 1770 and the French from 1772 were carefully reviewed, as well as the American inventions which began to come along about 1870. With this mass of information before him, Mr. Cyphers began carefully testing the various theories which had been advanced from time to time, and, by intelligent experimental work, eliminated the wheat from the chaff, sought out the hidden secrets and drew aside the accidental phenomena which veiled them, and with a master's hand began building up a perfect apparatus for incubating eggs.

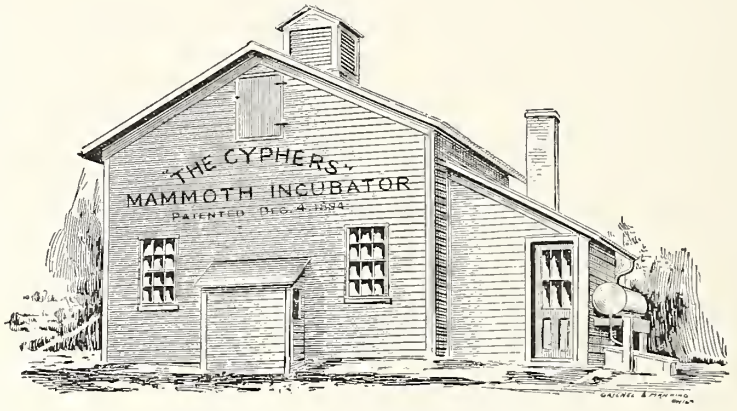
In 1894 "Incubation and its Natural Laws" was written and published, which received more favorable comment than any other work which has ever appeared in poultry literature. In fact, it is the only complete treatise on the subject that has ever been published, and is to-day the only handbook of the art.

The Cyphers Incubator was not put on the market when completed, but a few sample machines were first distributed in different parts of the country, where they were tried by old incubator operators, and at the close of the season were pronounced far ahead of anything that had yet been accomplished. In the meantime Mr. Cyphers had contracted with Mr. Truslow, of

Stroudsburg, Pa., for an experimental incubator to hold 20,000 or more eggs. In November, 1895, work on this mammoth machine was begun, and occupied Mr. Cyphers' whole attention until the following summer. A building 22 feet square was erected, with an egg-testing room attached 10 x 12 feet, under which the heater was located. The main building was put up substantially and warm, with 10-inch packed walls. An inner central hatching room was designed, 15 feet square, with the four walls, top and bottom, covered with felt, so that there would be no air currents in contact with the eggs, to secure a diffusive ventilation as had been previously done with the small Cyphers machines.

The next point was to heat this room, 15 feet square, so that there would be no variation on any one level. This was accomplished as had been first designed, by placing the heating pipes outside of the felt room, around the inner wall of the main building, making a separate circulating chamber, and securing diffusive heat as well as ventilation, which was also following natural laws and the design of Mr. Cyphers' previous invention, which had worked so well. So evenly was this room heated that the extreme variation on any one level was but half a degree.

The next point was to control the heat, and this was the first and most difficult problem to solve. It had been found necessary to use a coal fire to heat the water in the large circulating system employed to secure an even temperature in the hatching room, and the first apparatus put in was neither powerful nor sensitive enough to control a coal fire and this large circulating system. Various schemes were tried without success. Finally a spring motor was brought into play for power, actuated by a mammoth 10-foot multiple thermostat and electro magnet. The regulating apparatus was finally adjusted in such a manner that the rise of a hundredth part of a degree in the hatching room would cause the draught of the fire to be turned off. Should the fire have burned up so as to keep on heating the water in the circulating system more than was necessary, a rise of another hundredth part of a degree in the circulating chamber where the heating pipes were located (between the felt walls of the inner room and the 10-inch outer walls), one of the fingers of the giant thermostat closed the circuit on another motor, which unlocked and raised a cover to a vent leading into the cupola, letting the surplus heat escape. When the supply and natural loss of heat was balanced again, the vent was closed by a reverse action of the regulator. As the fire died down under a closed damper, the temperature in the hatching room falls a hundredth part of a degree, the thermostat, always sensitive and active, swings over a finger, closes the circuit and the motor opens the draught of the heater and allows the fire to burn up a little. So sensitive is the thermostat that it can be set to close the circuit with a thousandth part of a degree variation, making a cycle every half minute, but it was found that a tenth of this was all that was necessary, which opens and closes the draught on the heater and opens and closes the vent to the circulating chamber, making the complete cycle once every five minutes. So accurately was the system controlled that a variation of 45° in nine hours in the outer temperature only caused a variation of ½° in the hatching chamber.

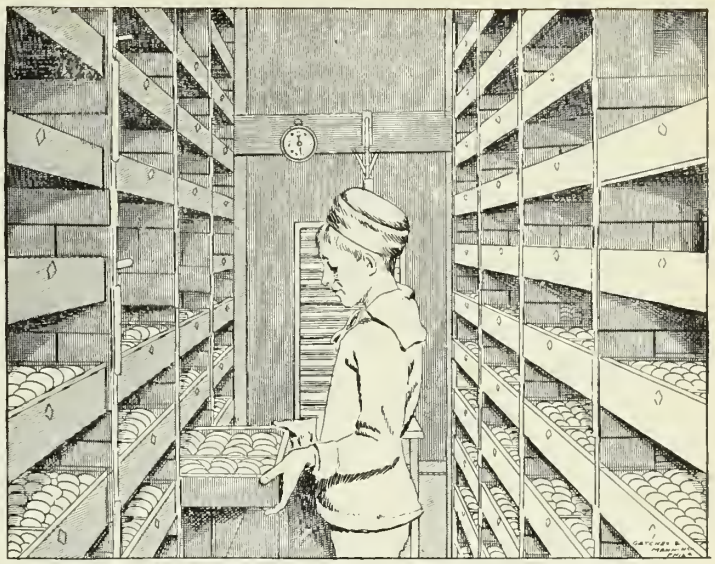


ON DUCK RANCH OF WILLIAM H. TRUSLOW.

While the action of this regulating device is now very simple as well as very accurate, the working out of the details took the better part of five months and the expenditure of about $1,000. The hatching chamber had an even heat on any one level, with a variation of about 3° between the top and bottom tiers of the eggs. This is the variation of the air temperature necessary to the first and last stages of hatching in a small incubator to take care of the animal heat, and in planning the Mammoth it was thought that would be all that would be necessary in it; so that by placing the fresh eggs on the top shelf and as incubation progressed lowering

them the 3° would take care of the animal heat generated. It was found, however, after putting in 10,000 eggs that the amount of animal heat generated was so large, that the 3° would not take care of it. The trays were now spread out to a height of 10 feet, but this only gave a variation of 7° between top and bottom, which was still not enough, and allowed the hatching eggs to overheat when the fresh eggs were at the correct temperature.

As the season was now far advanced, and both time and money allotted to this experiment were about used up, several straight hatches were run through the machine to test the efficiency of the regulating and ventilating systems. Between 2,000 and 3,000 eggs were employed at each test, and the results ran as high as 20 per cent. better than the hatches secured at the same time with the same run of eggs placed in the small machines run by Mr. Truslow at that time. Some high-priced settings of fancy hen eggs were put in for another party and hatched fifteen chicks from as many eggs, and another lot fourteen from fifteen eggs.



SECTION OF "THE CYPHERS MAMMOTH INCUBATOR," ON THE DUCK RANCH OF WILLIAM H. TRUSLOW.

This satisfied both Mr. Cyphers and Mr. Truslow that the invention was worthy of further effort, but Mr. Cyphers' time was up and so its completion was reserved for another time. He then went to Philadelphia to begin the manufacture of the Cyphers Incubators, 120, 220 and 360 egg sizes, which had proved so successful in the hands of others. The machine became well-known the first season, owing to its remarkable hatching qualities. The business grew so rapidly and required so large a capital to carry it on that in December, 1897, Mr. Cyphers took into partnership with him, Mr. Frank G. Patchin, of Wayland, N. Y., and considerable additional capital was put into the business. Mr. Patchin besides being an experienced poultryman is a young man of education and wide experience. He is a graduate of both Cornell University and the Albany Law School. After leaving college he entered into newspaper work by beginning as a reporter on the *New York Press*, where he developed a keen faculty for working up criminal cases. After two years work on the *Press* he accepted an offer from the *New York Journal* to become its day editor. From that he rose, filling successively every editorial position on the paper. But the old fondness for criminal research led him to resign his editorial chair and take up this line on the staff again. He succeeded in running down many famous criminals, and often where the police were unable to do so. In 1895 Mr. Patchin withdrew from New York newspaper work and accepted a position as city editor of the *Washington Post*, in order to gain a clearer insight into the workings and problems of National Government. After remaining there for a year and a half he retired from newspaper work in order to attend closer to his real estate interests at Wayland, N. Y., and devote more time to the development of his poultry plant.

In May, 1898, the works of the Cyphers Incubator Company were removed to Wayland, N. Y. Wayland is centrally located on the lines of the Delaware, Lackawanna and Western, Erie, and Central New York and Western, giving unsurpassed shipping facilities on two at least of the fastest freight lines in America. Rochester is forty miles away; Buffalo ninety, and Elmira fifty.

The new plant is the largest and most perfectly equipped of any institution of its kind in the world. The entire plant, covering the poultry division, covers an area of five acres, besides which there is an auxiliary poultry division on Mr. Patchin's 500-acre farm south of the town, where the young breeding stock will be kept.

The main factory building is three stories high, and contains 20,000 square feet of floor

space. It is fitted with the most modern machinery and equipments, steam-heated and lighted by electricity. A hundred-horse boiler and a sixty-horse engine in an adjoining building furnish the motive power. There is a storage house of 6,000 feet capacity, lumber houses, dry kilns, oil and varnish house, experimental station, where all machines are thoroughly tested, and several other buildings of minor importance.

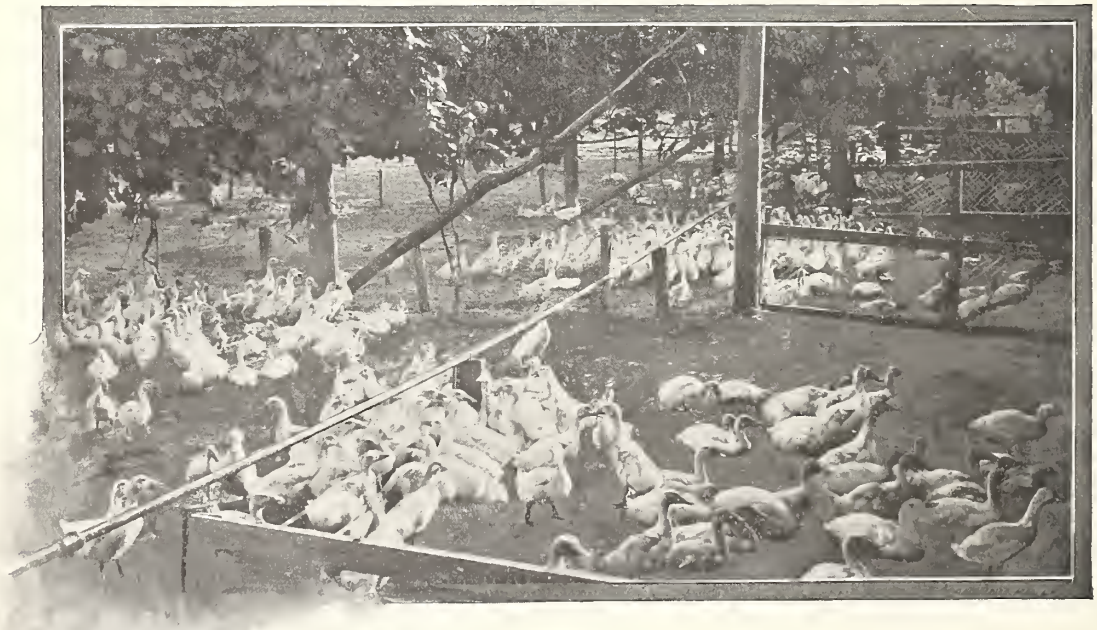
The lumber, coming in onto a private switch, is unloaded in one of the lumber houses, and from there begins its journey through the various departments. It is cut, planed and sized to fine measurements on the ground floor, from where big elevators take it to the floor above. Here the bench workers take hold, each man having his own special work, and by the time the incubators get around to the elevators again they are ready for the finishers. This part of the work is done on the third floor. After this they are sent to the regulating and testing department, and lastly to the packing room, from where they go either to the customer or into the storage warehouse. The brooders take the same course, excepting that they go to an entirely different set of bench workers after they leave the machine floor. Only labor of the highest skill is employed, and from seventy to one hundred men are required in the shops alone.

Nearly $50,000 has been invested in this plant, made necessary by the unprecedented demand for the Cyphers Incubators and brooders. On this plant will be erected a 100,000-egg Mammoth Incubator. Ever since leaving the Stroudsburg machine, Mr. Cyphers has continually kept the subject in mind and has made some experiments lately that clear up definitely the matter of making a complete success of it. Mr. Truslow's machine will be altered over, as soon as time permits, after the machine at Wayland, which is in active operation, and two others erected, for which the company has a standing order from two large breeders.

The question will naturally arise, what is the good of this Mammoth?

First, there is economy of operation. It is found that a ton of coal will run this Mammoth Incubator seven weeks ; that is, that three light shovels of coal fed to the heater once every six hours is all the fuel required. In the matter of time of operating, the economy is still more marked.

Mr. Truslow is an expert incubator operator, and operated thirty incubators of another make at one time. He says it took him about an hour and a half each morning and the same each night to turn the eggs, and fully an hour and a half to trim the lamps, making four and one-half hours a day



A PEN OF YOUNG DUCKS. DUCK RANCH OF WILLIAM H. TRUSLOW.

WM. H. TRUSLOW,

Breeder of Pekin Ducks.

Choice Fed Ducks of Our Own Raising Bear an Orange Tag on One Foot

WM. H. TRUSLOW — TRADE MARK — PEKIN — STROUDSBURG, PA.

Stroudsburg, Pa., Sept. 9, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

I don't know what I can do better than give you some figures of this season's hatching.

I set 22,848 eggs in Cyphers Incubators, and hatched 12,517 ducks, which is just short of 55 per cent. of all eggs set.

Leaving off the first and last month of hatching, during which time the eggs are never good, I set 17,250 eggs in Cyphers Incubators, and hatched 11,035 ducks, or just short of 64 per cent.

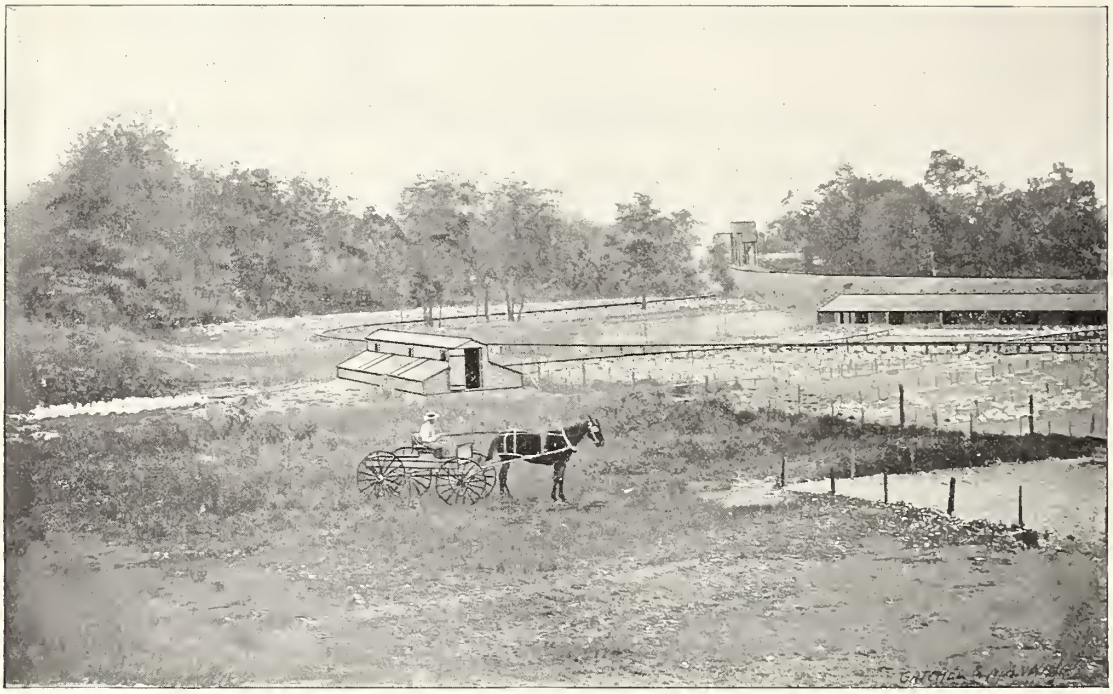
Yours respectfully,

WILLIAM H. TRUSLOW.

to care for incubators holding 9,000 eggs. In the Mammoth the actual time consumed in running the heater, testing the regulator, glancing at the thermometers, turning the eggs, etc., requires less than half an hour a day, leaving the operator free all the rest of the time for other work. The hatches run through this machine averaged from 5 to 20 per cent. greater than those run at the same time in the machines which Mr. Truslow used before putting in the twenty-six Cyphers a year ago, which have averaged the past season 14 per cent. better than his best season before. Nevertheless, he is anxious for the completion of the Mammoth on account of the economy in operating it. Mr. Truslow realizes its great value and wants to be the first in line, as he did when contracting for the experimental machine to be placed on his farm. It is the intention of the Cyphers Incubator Company to have one of these machines in the center of every thriving poultry district in the United States, where an expert operator can do the incubating for the community. To this end they intend to spare neither time nor money.

six Cyphers the past season. The percentage of hatch may not seem phenomenal to the beginner, but we consider it very good. His hatches with other makes of incubators in past seasons have run from 25 to 30 per cent., one year running up to 41 per cent. Very few of the large duck breeders who winter over more than 100 layers have ever hatched over 50 per cent. of all eggs set. Duck eggs do not hatch as well as hen eggs, but, on the other hand, ducklings are much easier to raise than chicks, so that the percentage of birds marketed to the number of eggs set is as high in one case as the other.

Up to three years ago, when the Cyphers Incubator was first put on the market, the largest general average for the season of all eggs set, made by the large Long Island duck breeders, was 38 per cent., and Long Island produces over 200,000 ducks each year.

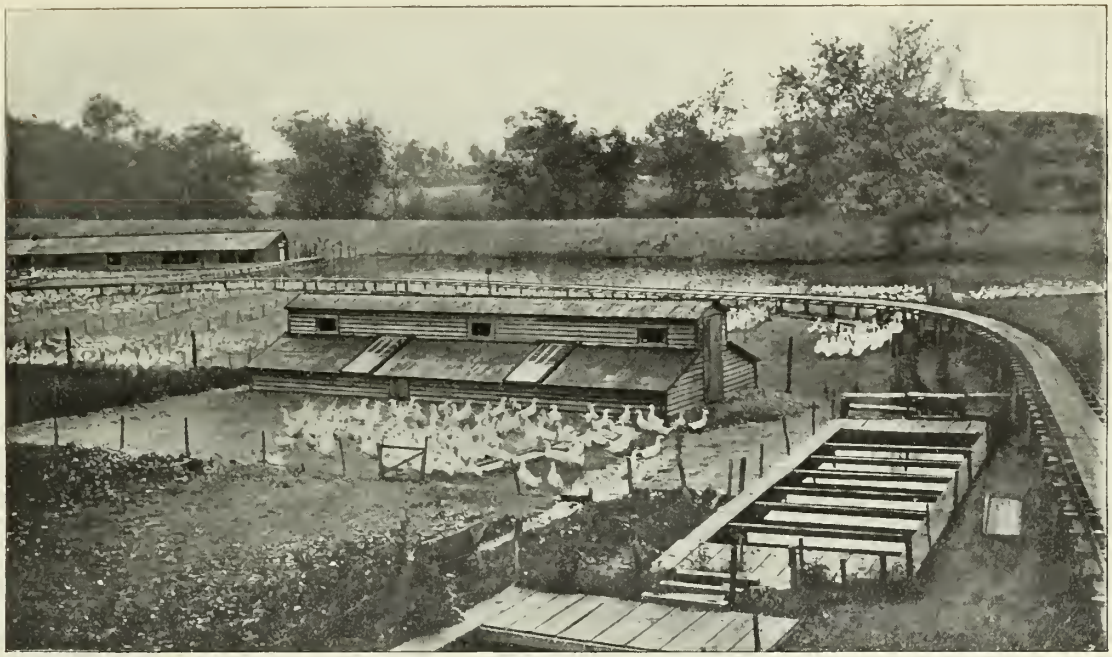


DUCK RANCH OF WILLIAM H. TRUSLOW.

MR. TRUSLOW'S RANCH.

On the opposite page we give Mr. Truslow's statement of the results obtained from his twenty-

Mr. Truslow is one of the most intelligent men we have met in the poultry business. He has made a careful study of conditions, of foods and feeding, and, in fact, of all the details of the business. During several years past all prime ducks shipped to the New York and Philadelphia markets have borne a tag on one foot, and as only choice specimens have this trade-mark, Mr. Truslow has worked up a good demand for tagged



DUCK RANCH OF WILLIAM H. TRUSLOW.

ducks, and secures a premium of from three to six cents a pound over best current quotations.

Mr. Truslow has a plant with a capacity of about 26,000 ducks a season, but has never got out over 10,000 or 12,000. He believes most emphatically in water for breeding ducks, and has small pools of thirty to fifty square feet for each yard. The water is supplied from several springs in a ravine below his residence. Part of the water is forced by two hydraulic rams to the brooder house, several hundred feet away and about seventy five feet higher up, the waste water being piped directly into his picking room and used for cooling the ducks before shipping, a long tank being divided into four compartments in which the pickers 'plump' their ducks, and this cold spring water flows over them constantly and obviates the necessity of buying ice.

The brooder house is 180 feet, double, with runs either side of the hover. A large feed house is connected with one end, in which the heater is placed.

The incubator room is a half cellar and contains twenty-six 360-egg Cyphers Incubators, Mr. Truslow having disposed of all other makes. The picking room is between the ravine and pond. Here also is a feed room, supplied with a steam heater, etc. From this room runs the track which winds down through the pens containing the breeders and thousands of ducklings from six to ten weeks old. Mr. Truslow prefers small ponds of water for the ducklings as well as the breeders, believing that they take on flesh faster when they have the water to cool off in after the weather grows warm.

Mr. Truslow was taught the value of fresh, unrelated blood in the school of experience. Like many other beginners, when he started in the business, some ten or twelve years ago, he had remarkable success with his first pen of breeders. The prevailing opinion at that time was that when a large number were kept they must necessarily inbreed very slowly, and fresh blood was not necessary. But experience has proven that, no matter how large the flocks, fresh blood is necessary every year to keep up the proper standard of vigor for good results. Most old breeders have been taught the same lesson by having the general fertility of the eggs go lower and lower each season until they awoke to a realizing sense of what the trouble was.

Mr. Truslow passed through this experience several years ago, and now not only buys fresh blood every year, but looks to it that this "fresh blood" is not inbred and is not related to his flock.

This season he has erected a 75-foot chicken brooder, and is going to try a hand at broiler raising to keep himself and help employed after the short duck season is over. We like this plan, and think Mr. Truslow will make a substantial addition to his profits by it.

CLEFT POULTRY FARM, SOUTH NATICK, MASS. OWNED BY MR. A. F. HUNTER, EDITOR OF "FARM POULTRY."

Mr. Hunter's farm is a money maker, and we take great pleasure in giving, in his own words, written especially for the benefit of our customers, his method of conducting it.

THERE IS PROFIT IN POULTRY RAISING.

Few people stop to think of the profit there is in keeping fowls for eggs, if the fowls are rightly handled, and the still greater profit if the eggs are turned into chickens and raised for market; and some, even, who have realized the handsome profit from a flock of a dozen or fifteen fowls, have never stopped to think that 150 fowls is simply 10 times 15, and that 1,500 fowls is simply 100 times 15, and that quite as substantial profit can be made from 150 or 1,500 fowls, provided the house and yard room is increased proportionately as the fowls increase, and the same good food and care is extended to the greater number that was given to the single flock. Becoming convinced some years ago that there was a goodly profit in poultry raising, I bought a farm about fifteen miles west of Boston, intending to keep poultry on a considerable scale, starting in the business with twelve yearling Barred Plymouth Rock hens and ten common pullets, which were purchased at a total cost of $19.50. I found, by experiment, that it was not at all difficult to get 150 to 175 eggs each from the birds within a year of laying maturity, and if that laying maturity was early in the autumn, before cold weather came down upon us, I could make those fowls pay me $2.50 to $3 apiece profit within a year, an essential requisite being the sale of the birds to market just before they began to moult, and replacing them with another generation of well grown and early laying pullets An important part of this profit is the eggs that are laid in November, December and January, when most of the old hens are moulting, and laying little if any, hence the importance of disposing of the old stock (or the bulk of it), and having a succession of pullets with which to fill the houses about October 1st.

The price of eggs is at its highest in November, gradually receding as more pullets come to laying (or the old hens return to laying) through January and February, reaching the lowest point about April 1st, when everybody's hens and pullets are doing their best in egg production. As the volume of eggs begins to decrease, owing to large numbers being incubated to produce chickens, and quite a proportion of hens are used in incubation, the price gradually rises again, until it again reaches the maximum in November. The highest price in the New England and Middle States in the last ten years has been 40 to 42 cents a dozen, the lowest 14 to 15 cents, and the average price for the entire year has been 25 to 27 cents. This liberal average price, however, is only where a reasonable proportion of eggs are produced in November and December. If one's flock is one half old hens and the other half late hatched pullets, that produce hardly any eggs through November, December and January, not only is the total number of eggs decidedly less, but the average price is decidedly lower, probably 18.

to 20 cents rather than 25 to 27 cents. It should be constantly kept in mind that there is a solid foundation for this liberal profit from egg production, and that foundation is early hatched pullets kept growing so they shall reach laying maturity by November 1st, and then kept laying by good care and good food.

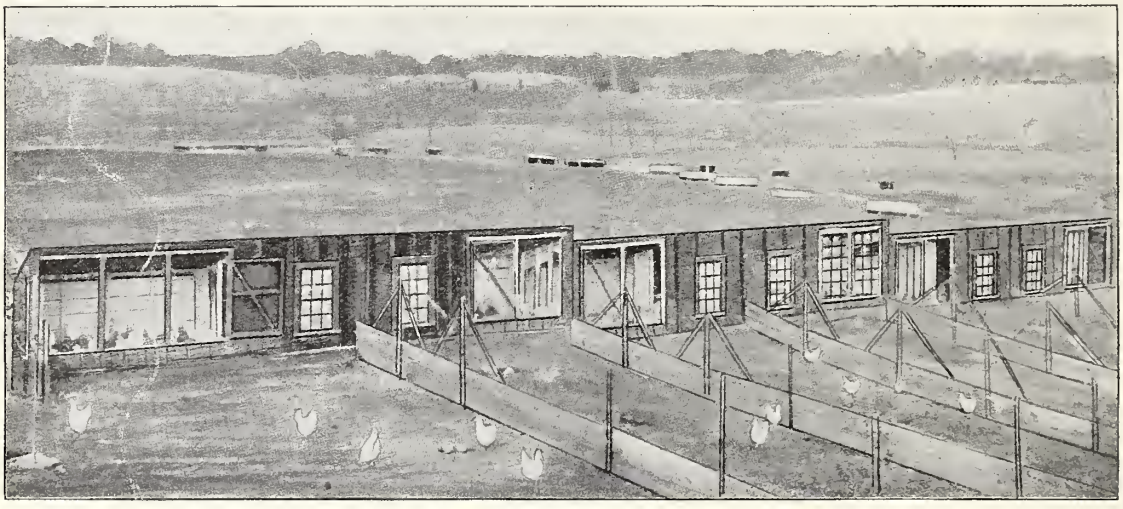
By a strict adherence to those foundation principles any one may make $3 a year profit from each bird kept, whether the number be 15, 150 or 1,500, or more, always keeping in mind the essential factor that house room must be increased as the number of fowls is increased, and the care and food proportionately.

Not only can this liberal profit be made from egg production only, simply raising enough chickens to reproduce the laying stock each year, but a very material increase can be made to the profit by turning a portion of those eggs into chickens through January, February and the last half of March. There is a great scarcity of choice chickens in March and April, consequently choice chickens bring good prices, hence anyone having the facilities for raising chickens for market can greatly increase the profit by turning a portion of the January and February eggs into chickens for market. There is a good illustration of this in an account which I have of a farmer who made $50.00 a month net profit during the six months from January 1st to July 1st, on market chickens which were sold alive at the door to the poultry buyer, the total number of 727 chickens selling for $636.95, an average of about 90 cents per chicken, and as the chickens cost to raise not far from 45 cents apiece, they paid him about 100 per cent. profit. This, it will be observed, was over and above his eggs-for-market business, and the 45 cents average cost of hatching and raising the market chickens includes the price he paid the market eggs account for eggs from which to hatch the chickens.

One of the most successful poultrymen of whom I have knowledge, Mr. C. H. Wyckoff, of Groton, N. Y., keeps about 600 head of laying fowls solely for eggs for market, and has made a record of 196 eggs per year from each one of his 600 head; that is, he had a total egg yield of 117,600 eggs within the twelve months beginning October 1st, and as those eggs averaged him 25 cents per dozen by the year, he received $4.08 gross income from each of the 600 birds. Allowing $1.08 each as the cost of the food there is $3.00 net profit per bird for eggs alone, or $1,800 net profit on 600 birds. If 1,000 of those eggs had been incubated in January and February and turned into market chickens, as in the case cited above, between three and four hundred dollars additional profit would have been added to the account.

It might well be asked why everyone doesn't rush into the poultry business if it pays so well. Many do, and fail of success because of lack of persistence, or intelligent appreciation of the problems involved. One of the most common causes of failure in the business is the rushing into it of people who think it is perfectly easy to keep hens, never considering that it requires judgment in feeding, persistent application in care and constant study of problems involved. The only wise course is to start small and increase the business as knowledge and experience are gained; first succeed well with a small flock, then increase. The Mr. Wyckoff mentioned above, started with 25 common hens, and when he bought the farm on which he now resides he had not a dollar in his pocket with which to pay for it. He gave an endorsed note for the first payment on the farm and borrowed a little money with which to buy a cow, horse, a few farming tools and 25 common hens. All of the income from the hens he turned into more hens, getting his entire living out of the old worn-out farm, with the help of the kitchen garden and the cow. The first year he kept but 25 hens, invested the money he received for their eggs in Plymouth Rock and Brown Leghorn eggs from which he hatched chickens for his second year's business. From the eggs produced by these flocks he saved up $75, and the second spring invested it all in White Leghorn eggs, so that the end of the season he had 180 good White Leghorn pullets, which in January alone of that winter gave him $90 worth of eggs. My individual experience was very similar. Beginning with 22 hens and pullets housed in the basement of the barn, I bought eggs for hatching the following year, also hatched the best of the eggs of the yearling Barred Plymouth Rock hens, and started in the second winter with about 70 well matured pullets, which laid vigorously all through the winter, spring and summer succeeding, and I found at the end of the year when the account was closed, that they had paid me over $200 net profit. The next year more chickens were hatched, an addition built to the poultry house of the year before, and our growth has been continuous, until now we have a capacity of about 600 head of laying stock and raise about 2,000 chickens annually. I have come to believe very firmly that it pays to give fowls a liberal amount of house room, and a sufficient amount of yard

room so that they shall have grass growing all the growing season, and have sufficient exercise for good health, but not room for wasteful exercise. Fowls given free range will expend a good deal of physical energy in ranging and that energy can be diverted into egg-production if the ranging is limited to a reasonable-sized yard. I give my laying fowls 10 square feet of floor space in the house and about 100 square feet each of yard room outside, the two long houses on my farm being divided into pens 12 feet square each, with a 3-foot wide walk extending the entire length of the house at the back. The houses face slightly east of south, and each pen of fowls has a yard 125 x 12 feet extending south from it. What I now consider a better plan of house is the scratching shed house described in another article in this catalogue, and instead of yards 125 feet long, as heretofore built, a better plan would be to have the individual yards but 40 feet in length and throw the balance of the space into a large yard, which for the scratching shed house would be 85 x 36 feet, for the long houses 85 x 24 feet, each abutting family of fowls being given the run of the larger and well grassed yard every other day.



A. F. HUNTER'S FARM.

Poultry houses if well built will last many years, but to maintain good health in the flocks they must be thoroughly cleaned up and whitewashed each year. We renew ours, practically *make them new*, by a thorough cleaning and whitewashing, removing the sand floor for a depth of three or four inches, carting in new, fresh sand to take its place, thoroughly cleaning and renewing the nest boxes, roosts, roost platforms, etc., etc.; then, having sold off the old fowls to market about October 1st, we bring in the well matured pullets, some of which will have already begun to lay while still out in the field where they were raised.

An essential factor in a good egg yield is a liberal ration of egg-producing food, that is, a food ration which contains the egg-making elements. Without at all claiming that my method is the best in the world, I do claim that it has produced excellent results here on my farm. I feed three times a day the year round, feeding a mash of vegetables and mixed meals five days in the week and grain for noon and night feeds as also for the morning feeds on the two days when we do not have the mash. The morning mash is made up of about one-third cooked vegetables mashed fine, or cut clover cooked by being brought to a boiling heat in water. An equal quantity of boiling hot water is added to the vegetables (or clover), salted about as if for human food, and into this is stirred a meal mixture until the mash is as stiff as a strong arm can make it. The meal mixture consists of one part by measure of corn meal, fine middlings, ground oats and meat meal and two parts of bran, or shorts as it is sometimes called. The thorough mixing of these meals we consider a strong factor in making a good mash. The foundation of the mash is the vegetables or cut clover. The vegetables may be potatoes, beets, carrots, turnips, onions (anything in the vegetable line), and into the pot goes the table waste, potato and apple parings, etc., from the kitchen. The vegetables are washed before being cooked, and the mash when well boiled is sweet and

savory. The pot of vegetables or clover is put on the fire before going in to dinner and an additional kettle of water to be boiling hot when wanted. When the vegetables are cooked we empty them into a food mixing trough, mash them thoroughly, add the salt and boiling hot water, then stir in the mixed meal until it is stiff and firm, cover it and set away to cook in its own heat until next morning.

This breakfast-mash, it will be noticed, contains a great variety of food elements, and this *variety* is quite an important factor. A fowl needs a variety of foods to supply her various physical wants and give her a surplus out of which to make eggs, and this can best be supplied in the manner here described.

This morning mash is fed in troughs large enough for all the fifteen fowls in a pen to get about it at one time—another important factor—because, if the trough is too small some of the birds have to stand back and wait for "second table," and when their chance does come there is nothing left. With a trough 4 feet long by 6 inches wide, there is abundant room for fifteen fowls. In the scratching shed house, with twenty five birds in the pen and shed, we put two feed troughs for each family.

In cold weather exercise must be promoted, and I cover the pen floors 3 or 4 inches deep with straw or meadow hay, into which the dry grain of the noon and night feeds is thrown so that the birds have to scratch to get it. Some people will find leaves or chaff the most available scratching material; what the material is is of far less importance than that there be scratching material in the pens.

Whole wheat is the best grain food for laying fowls, oats and barley being the next best, and buckwheat (where obtainable) being another good food. We make oats, barley (or buckwheat) the noon feeds five days in the week, and wheat the night feed five days in the week, and our menu for the week with the mash not made up on Sunday and Wednesday, would be as follows:

Monday . . . . Oats (or barley), Wheat, Whole Corn.
Tuesday . . . Mash, Barley (or buckwheat), Wheat.
Wednesday . . Mash, Oats, Wheat.
Thursday . . . Barley, Buckwheat, Corn.
Friday . . . . Mash, Oats, Wheat.
Saturday . . . Mash, Barley, Wheat.
Sunday . . . . Mash, Buckwheat, Wheat (or Corn).

Whole cabbages are hung in the pens in cold weather to tempt picking off to get green food, or turnips, or beets or carrots are split in halves and placed in the pens to be picked in pieces and eaten. In spring, summer and early fall green food can be obtained from the grass runs; should the yards be bare of grass the clippings from the lawn mower and weeds from the garden supply excellent green food.

Ground oyster shells, grit and granulated charcoal are kept accessible to the fowls in small troughs in each pen, and cool, fresh water is supplied them twice a day in winter and three times a day in summer; in fact, cool, fresh water is always before them. Milk in any form, sweet or sour, whole or skimmed, in curds, or, in fact, in any form, is a most excellent food for both laying hens and chickens, and if one has milk with which to mix the food a considerably smaller quantity of meat meal, will be needed in the mash; as milk is an excellent animal food.

The best time to hatch chickens for laying stock is the last of March for the Asiatic varieties, early April for the American, and about May 1st for the Mediterranean varieties; and for the best growth the cockerels should be separated from the pullets as soon as they can be recognized. On my farm the cockerels are kept yarded until large enough to be sold to market, and then are sold off out of the way. The pullets are put out in the grass fields in families of twenty-five or thirty each, in coops set about 150 feet apart, and they are given free range, with an abundant supply of muscle- and flesh-forming foods, of which oatmeal is an important part, and given every opportunity to grow. Well hatched and well grown pullets should lay at five and one-half to six months old, and Plymouth Rocks or Wyandottes hatched April 1st and rightly managed, should reach laying maturity about October 1st. Then, if moved into fresh, clean quarters and fed as I have described, they should lay steadily throughout the year, excepting the short rest at the end of each litter, and if of a good laying strain, fed and handled as I have described, will produce from 175 to 200 eggs apiece within a year. Along in September, when time to get the houses ready for the next generation of laying pullets sell them off to the butcher, and the amount they are sold for increases the gross receipts and also the net profits of the year. I have proved over and over again here on my farm that the cockerels hatched with the pullets will sell to market (when weighing about four pounds each) for enough to pay for their own food and that of the pullets also, so that the pullets at laying maturity cost nothing but the care; the cockerels have paid for all the food. By following this plan of early hatched pullets kept growing so that they reach laying

maturity in October, $2.50 to $3 a year profit can be made from each fowl kept, the essential part being that they shall have reasonable house room, an abundant and well-balanced food ration, and good care. By hatching and raising chickens for market the profit per fowl can be doubled, the profit figured here being from eggs alone.

A. F. HUNTER.

South Natick, Mass.

Scratching shed plan used by Mr. Hunter —from *Farm Poultry*:

We give herewith drawings of the scratching shed plan of poultry house, with details of the shed and pen plans, the curtains in front of the open shed, etc.

The house can be built of any length desired, the pens and sheds being in groups of two, with doors opening through from pen to pen and from shed to shed, so that the whole house can be passed through without going out of doors. Each roosting room is 8 x 10 feet, and each shed (adjoining) is 10 x 10 feet, the front being 7 feet high, the back 4 feet high. We advise these heights because a 6-foot high front makes doors rather too low for a tall (or tallish) man, and head-bumps should be avoided if possible.

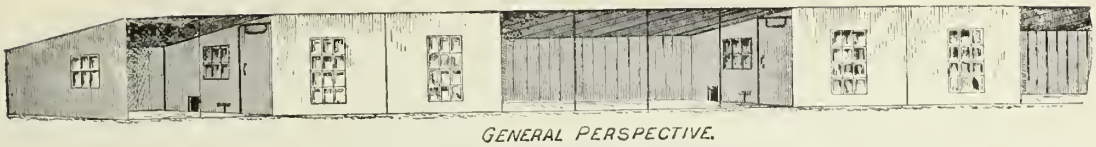
Some will ask, "Why not the walk at the back?" There are several reasons why we prefer the greatest height in front. First, economy. The walk at the back adds three feet to the width of the house, and increases the height at back by two feet, increasing the cost about a fourth (25 per cent.), and we don't think the corresponding advantages balance the disadvantages and added cost. Having the walk at the back, we must have six feet of height there, adding not a little to the cold temperature in winter. We must also have a door at the end of each pair of roosting pens, or else a solid partition (and door) between walk and scratching pen. True, we could have the double-pitch roof, or the long- and short-pitch roof, with the apex over partition between walk and pens, but to get the desired seven-foot height of front we would have to boost the roof up into the air two feet, making the house much colder. We very much want that seven-foot height of front; then, in winter, when the sun doesn't climb high, the whole floor of the scratching shed is bathed in sunshine. This was capitally illustrated on our farm one winter when we were showing Mr. Cannon, of the *Poultry Herald*, about. It was mid-forenoon of Washington's Birthday that he was there, and at that time the sunlight completely flooded the whole floor of the scratching shed, extending up the back wall nearly a foot, so that, on any part of the floor of that shed, a fowl was *all* in the sunshine; that is, was "in the sunshine all over," and that is the ideal condition for fowls in winter. The shed having a tight roof, and being tight on the north and west, is all open to the south (when the curtains are up), giving the birds fresh air and sunshine; at the same time that they are protected from our cold northwest winds.

By this plan of house, too, the roost and roost platform are at the back, cut off from winds and draughts, and at the same time the roof is but about two feet above it. A curtain can be hung above front edge of roost platform, extending almost down to it, and this, let down on cold nights, encloses the birds on the roosts, keeping them snug and warm. We would have the north wall of this roosting pen double boarded, so as to have a dead air space; the inner boarding being of matched boards, the outer of cheapest rough boards, covered with two thicknesses of Neponset paper; red Neponset roofing outside, and sheathing paper underneath that, next the boards.

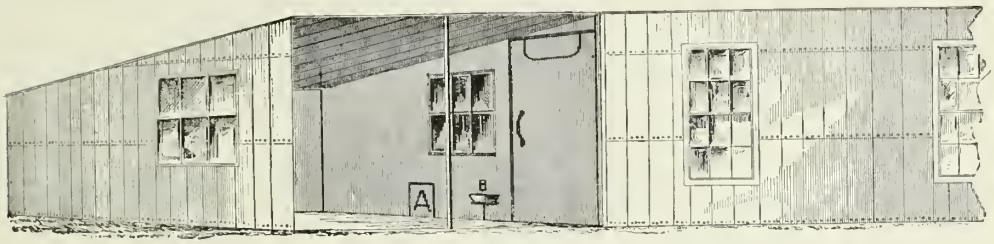
We gave a plan of the scratching shed house in *F. P.* for June, '93, the house shown in that plan being the single house which Mr. Cannon and many others have been so greatly pleased with. The house plan given in this number is the same plan in groups of two houses and sheds together, and extended indefinitely; and this shed and pen plan of house will give the best results for dollars expended. Each combined pen and shed is 18 x 10 feet, and will well house twenty-five fowls; and as it is the most economical plan to build upon, it is easy to see that it is by all odds the best for the man who has to make his dollars go as far as possible. For these reasons we recommend this compact open shed and roosting pen plan of house as being the best all-around house that can be built. We have 108 feet (in length) of this house on our farm, and find it just about perfect.

CONSTRUCTION.

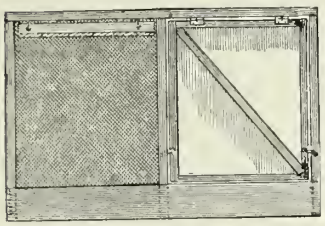
We intend that the top of the sills of our house shall be about 1 foot above the ground level (we fill inside to bottom of sills, and slope up the ground outside to nearly same height). The sills are 2 x 4 scantling, halved and nailed together at splices and corners. The sills rest upon posts of cedar or chestnut, which go into the ground about 2 feet; if it is a 3-foot length of post it will go into the ground 2 feet 2 inches, and extend above the ground 10 inches. There



GENERAL PERSPECTIVE.

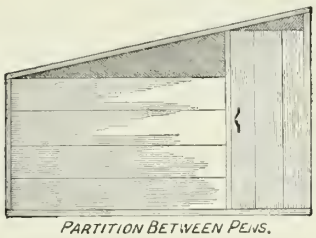


A SHED AND PEN

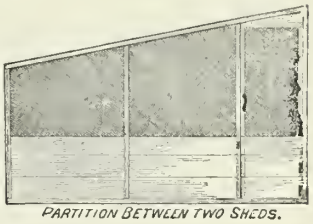


THE CURTAINS,

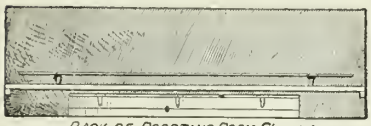
Showing one down in place, and the other hooked up out of the way.



PARTITION BETWEEN PENS.

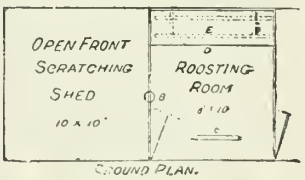


PARTITION BETWEEN TWO SHEDS.



BACK OF ROOSTING ROOM, Showing Roost, Platform & Nest Boxes.

FRONT OF SCRATCHING SHED, Showing Wire & Studding.



GROUND PLAN.

NEST BOXES.

THE SCRATCHING SHED HOUSE.

A—Slide Door. B—Water Pan. C—Feed Trough. D—Roost Platform. E—Roosts.

should be one at each corner of pens and sheds, and also one between each of these—giving a post to each 5 feet of front of sheds, and each 4 feet of front of pens. It will strengthen the building not a little to have one in the center of each cross partition, also, although that is not vitally necessary. Instead of posts we sometimes use pieces of scantling about 18 inches long, reaching to stones set down in the ground to about the right depth. In that case the stone is the foundation, and the piece of scantling is a "stilt" to support sill. A board 1 foot in width is nailed along lower half of sill, extending into the ground 3 or 4 inches; the ground is "channeled" to receive it. This board laps 1 inch onto sill (leaving the other inch of sill to nail upper boarding to); it is also nailed securely to foundation posts, or stilts. In a country where small stones are plenty, a stone-wall foundation, 10 inches high, will be easy to build, and will be cheap.

The plates are 2 x 4 scantling, same as sills, and are halved and nailed together at splices and corners. A sufficient number of studs, 6 feet 8 inches long for the front, and 3 feet 8 inches long for the back, are cut from the 2 x 4 scantlings, one for each corner of the pen and shed. These are toe-nailed onto sills, and the plates spiked onto top of them. We set an intermediate stud in front of each scratching shed, preferably of 2 x 4 stuff (though 2 x 3 will do), and two 2 x 3 studs in front of roosting pen set the right distance apart to receive the window intended to be used. At the back we use one intermediate stud

of 2 x 4 stuff in each pen and shed. As we purpose double boarding this back wall, boarding on the inside of studs with matched boards, we use the 2 x 4 studs, and thus get the 4-inch dead air space; a 2 x 3 intermediate stud would give a 3-inch air space only, but would bring inner boarding flush with outer edge of corner studs, if one preferred that finish, a strip of furring being nailed onto side of corner studs to nail ceiling boards to.

Rafters are of 2 x 4 scantling, notched and spiked onto plates, as shown in cuts, the top end cut flush with outside of plate, the lower end projecting about 8 inches, and mitered to nail a gutter to. It is best economy to set rafters 2 feet apart, as boards come 10, 12, 14 or 16 feet long, and having rafters 2 feet apart saves cutting boards to waste, also makes a stiff roof. All outside boarding is lengthwise of buildings, and is cheapest hemlock boards, put on with as slight cracks as possible, then covered with, first, black Neponset sheathing; then, second, Neponset red rope roofing. This is put on lengthwise of building, also, each strip lapping about 3 inches, and secured with the tin-head nails provided with each roll. The tin-head nails should not be over 3 inches apart, and about ¼ inch above the edge (back from the edge) of top lap. We add battens, stripped ½-inch thick from ⅞-inch boards, putting them on over the rafters, 2 feet apart. We give the roofing paper a coat of paint, and also paint the battens before putting them on, then put on a second coat of paint over battens and all.

A twelve-light window of 8 x 10 glass is set in the middle of front of roosting room, and a half-window (six lights, 8 x 10 glass) is set in each partition between shed and pen. This, however, may be omitted if one prefers. The whole window, in the front, is better for being set in a window frame, so the lower half can be raised in hot weather. All our windows are protected by having wire netting tacked to frame on the inside; this is as much to prevent the fowls flying against and breaking the glass as to keep cats, etc., out when window is open.

The partitions between two scratching sheds are boards up to a height of 2 feet, then wire netting, the 2-foot wide door being of light (furring) frame and same materials, two 2 x 3 studs, one to shut door against and the other about half way between door and back. The same studding supports the partition between sheds and roosting rooms, one stud supporting the door, the other being set to support the half-window. The partitions between roosting pens have two studs, one to shut door against and the other half way to back; this partition is boarded up to bottom of rear plate and then wire netting above, for ventilation. In warm weather the doors to open sheds are left open, being fastened back by small hooks and screw-eyes; these, with the open slide doors and open windows, give excellent ventilation. The ventilators in top of doors between sheds and pens (shown in cut) can be left open in cool (not cold) weather, and the slide doors to sheds being left open in cool weather, give additional ventilation.

The roost platform is 3 feet wide, as long as will go easily in between the partitions, and rests upon strips of furring securely nailed to the partitions, the top of rest being 20 inches above floor. The platform we make of matched boards, and edge it with a strip of furring all around, so that it is a shallow pan 1½ inches deep. The two roosts are of 2 x 3 scantling, slightly rounded on top, and are 15 inches apart, the rear one being 10 inches from the back wall. These are secured to two strips of furring, which are hinged to the wall at the back 6 inches above platform, and two 6-inch long legs at the front end of these cross-pieces are the front supports. Hinged at the back the roosts can be tipped up out of the way when one wants to clean (or remove) the platform, a hook and screw-eye securing it up against the roof. We cut the roosts 6 inches shorter than the roost platform, so they come 3 inches within it at each end. The bank of nest-boxes is explained by the illustration, is set under the roost platform so the fowls can go round the ends and enter any apartment from the back, the front (hinged at top and secured by a simple button at the bottom) lifting up to allow of removing the eggs. Keeping this front closed makes the nests dark and secluded, most important aids to preventing the forming the egg-eating habit—and biddy "loves a secluded nest."

THE SHED AND CURTAINS.

We make the plan of scratching shed 10 x 10 feet, and plau for two curtains 4½ x 5 ½ feet to close the front. Both these curtains cau be hinged to right and left, the right hand one being a door (as shown) to admit to shed and thence to pen; or they can be simple curtains on frames secured by buttons, excepting that the shed at end must have a door for entrance.

The curtains we have used have been simple muslin (cotton sheeting) tacked to frames of

furring strips (as indicated by dotted lines), the muslin being oiled (with linseed oil) after being tacked on. One drawback to this is that the oil oxidizes, rotting the muslin in a couple of years, and we purpose shellacking the next curtains we make. A simple process of waterproofing is desirable, and the waterproofed sheeting prepared by Messrs. Derby & Abercrombie, 36 South Street, New York, is just the thing for this purpose. A waterproof sheeting suitable for these curtains is usually on sale at seed store.

We have seen these curtains hinged at top, swinging out and up. This exposes them very much to high winds, and unless they are swung high up they cut off the desired sunshine. The poultryman who tried that plan didn't like it, and doesn't recommend it. A better plan (and probably the best) is to have the curtains hinged at top so as to *swing in and up along the roof rafters*, where a hook secures it. This plan has many advantages, not the least of which is the having the curtains hung up out of the way all summer, when they are not wanted. Care has to be taken that the doors between pens and sheds are cut sufficiently low to not interfere with the curtains; or, rather, that the curtains are up out of the way of the doors. Another thing, they should swing well out to front of studs (almost flush with front of studs), and the 8-inch wide board at the bottom should be inside of (within) the drip from the curtains, else when it rains against the curtains they will conduct the water *into* the scratching shed; that *must be* avoided. We put a 6-inch wide board along the top of front of the shed, covering end of rafters and front of plate, for finish. A similar board, 8 inches wide, is nailed along the bottom, to secure scratching material within and keep water out. If the curtains swing in it would be well to slant this bottom board, from flush with outer edge of sill to within the drip of the curtains, when it would conduct that drip outside the sill.

CONCLUSION.

We strongly recommend this open front shed and closed roosting pen plan of house as being

HOME OF H. G. HUEY, PROPRIETOR EXCELSIOR DUCK YARDS.

far in advance of all other poultry house plans. We have tried one for three winters, housing thirty birds in a house 10 x 24, the shed being 10 x 12, and pen ditto. The birds wintered in that scratching shed house have been the brightest, healthiest, and laid the best of any on the farm, and we have come to believe the open front shed and pen the best plan yet. The long house divided into pens 12 x 12, with a walk at the back, is a *good* house, far and away above most poultry house plans, and has, here and elsewhere, given excellent results. The point we want to especially emphasize is that the scratching shed house is much better than any other. The open front shed gives fresh air and sun bath, invites to exercise, and promotes the animal well being; it is by all odds the best plan yet.

BREEDING PENS, EXCELSIOR DUCK YARDS.

One objection offered to this plan, and size of pen, is that twenty-five birds are too many for one male, hence these large pens are not well adapted for breeding stock. The consensus of opinion favors about twelve females to a male of the medium breeds, and about ten of the larger breeds. We purpose putting twenty to twenty-four females in these pens, having two males for each; running one male in the pen for two days, then the other for two days; the male that is out being in a coop by himself and "fed up" for better service after he has had the rest. This method is employed with excellent results in fertile and hatchable eggs on some farms we have visited, hence it isn't an experiment. As not all the pens on a farm are needed for breeding stock, we can cull each pen down to eighteen or twenty females, temporarily increasing the number in the pens unmated.

Some doubts have been expressed, also, as to the adaptability of this open shed plan of house to a cold and windy country. For example, a farmer in Central Maine argued strongly against it at a farmers' institute where the writer was lecturing last winter. He said: "Take to-day, for an example. It's been fair, but a fierce wind blowing and snow flying. That open shed would be drifted full of snow in a few hours on such a day as this!" and a correspondent in Central New York writes us that "the open front shed would be blown full of snow in no time." In such case we wouldn't open the curtains, and the fowls would have the fresh air of the shed to exercise in, and that fresh-air bath is worth a great deal. There are a few days in

winter, stormy or blowy, when the curtains would need to be left down; but those days *are few*—a dozen, perhaps, in a winter. On all other days the shed can be all open front (the curtains being open by 9 or 10 o'clock in the forenoon, and closed by 2 or 3 or 4 o'clock in the afternoon, according to the weather), and is closed on the north and west, giving perfect shelter from our cold winter winds. Those words "perfect shelter," just express it and that perfect shelter means healthy, happy fowls—and eggs in the nest!

Wire netting, 2-inch mesh	$2 00
Waterproof sheathing, 12 yards, at 15c.	1 80
Hardware (door handles, hooks, nails, etc.)	1 00
	$50 16

YARD FENCES.

700 feet hemlock boards, at $15	$10 50
350 feet wire netting, 4 feet wide	5 80
15 10-foot posts, at 20c.	3 00
	$19 30

[These prices are taken from our lumber bills, and are adapted to the vicinity of Boston.—ED.]

BREEDING PEN, EXCELSIOR DUCK YARDS.

LUMBER SCHEDULE.

For house 36 feet long, having two pens and two sheds.

8 pieces 2 x 4 scantling, 18 feet long } 4 pieces 2 x 4 scantling, 10 feet long } at $17	$2 10
20 pieces 2 x 4 scantling, 12 feet long, at $17	2 72
200 feet 2 x 3 scantling	3 40
250 feet matched spruce boards, at $18	4 50
1000 feet hemlock boards	15 00
32 feet 2 x 3, planed 4 sides, at $20	64
2 bundles furring, 16 feet long	1 50
2 windows, 12 lights, 8 x 10 glass, and frames	2 50
2 rolls Neponset red rope roofing	10 00
2 rolls Neponset black sheathing	3 00

4,600 DUCKS ON FOUR CITY LOTS.

SUCH IS THE RECORD MADE BY H. G. HUEY, NORTH WOODBURY, N. J.

Mr. Huey's success is a good illustration of what a man can accomplish in the poultry business with but a little capital and a very small plot of ground. While still a lad, Mr. Huey went to Philadelphia to enter the office of a large wholesale grocery house, where he made himself so useful that he was gradually promoted to head bookkeeper, with a salary of $1,300 a year. Being a young man of considerable energy, the

EXCELSIOR DUCK YARDS

Pekin Ducks

WHITE WYANDOTTES

North Woodbury, N. J., Sept. 9, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

Incubators purchased of you have done excellent work, hatching a larger per cent. than the ----, and the ducks from your machines are as uniform a lot as I have ever hatched

I ran your machines in my new Incubator House, which not being completed had a variable temperature, varying as much as 25 degrees, and going as low as 20 degrees above zero, but machines were not affected in the least; set regulator for 102½ degrees, and there it stays. Your system of ventilation which preserves moisture solves one of the difficult problems of "Artificial Incubation."

You have a good machine; to try it is to be convinced.

I am yours truly,

HORACE G. HUEY.

YOUNG DUCKS, EXCELSIOR DUCK YARDS.

limitations of his position chafed. He figured that if his employers could afford to pay him $1,300, he must be worth considerable more to them, and if he was worth more to them, he would be worth equally as much working for himself. So he looked around for more lucrative employment, where he could be his own employer, fighting his own battles instead of others', and receiving the just reward for intelligent labor.

While in this frame of mind, his attention was called to the possibilities of the poultry industry. He moved from the city proper, where it had taken his entire salary to live, to the suburbs, where he secured a small plot of ground. His first purchase was six ducks and a drake, and a 100-egg incubator. He later bought a pen of Barred Plymouth Rocks and White Wyandottes; the latter he still continues to breed as a side to his rapidly growing duck business.

This was four years ago. The first season he saved forty-four ducks from those raised, and purchased drakes from Truslow for the next season's work. Finding he would need a little more room for his infant industry, he purchased the place at North Woodbury, where he now lives. Here he had a plot of ground, 150 x 350 feet, including that on which his residence stood. This house and four lots he purchased for $1,700, paying $180 down, all he had laid aside for that time. Still continuing his employment in the city, working night and morning, and Mrs. Huey doing the noon feeding, he raised 1,492 ducks.

Mr. Huey now felt that he had the business in hand so that he could make it pay running expenses, if not as much as he was making in the city. He, therefore, saved over 100 ducks, buying his drakes of Weber Brothers for the next season's work, thus getting new blood every year. That fall he purchased four more incubators, and in the spring a Cyphers, and turned out as his third season's work, which was the first season he gave it his entire time, 4,600 ducks. It must be remembered that this was done upon a plot of ground 150 x 350 all told.

Last fall he purchased two and one-half acres additional, paying $400 an acre. He put in an artesian well, which cost $520, built an incubator room and warm nursery, put up a long breeding house, etc., and kept over 300 breeders, and purchased his drakes from Pollard. He also put in nineteen Cyphers Incubators. The results of the season's work have been between 8,000 and 9,000 young ducks sold, together with about 4,000

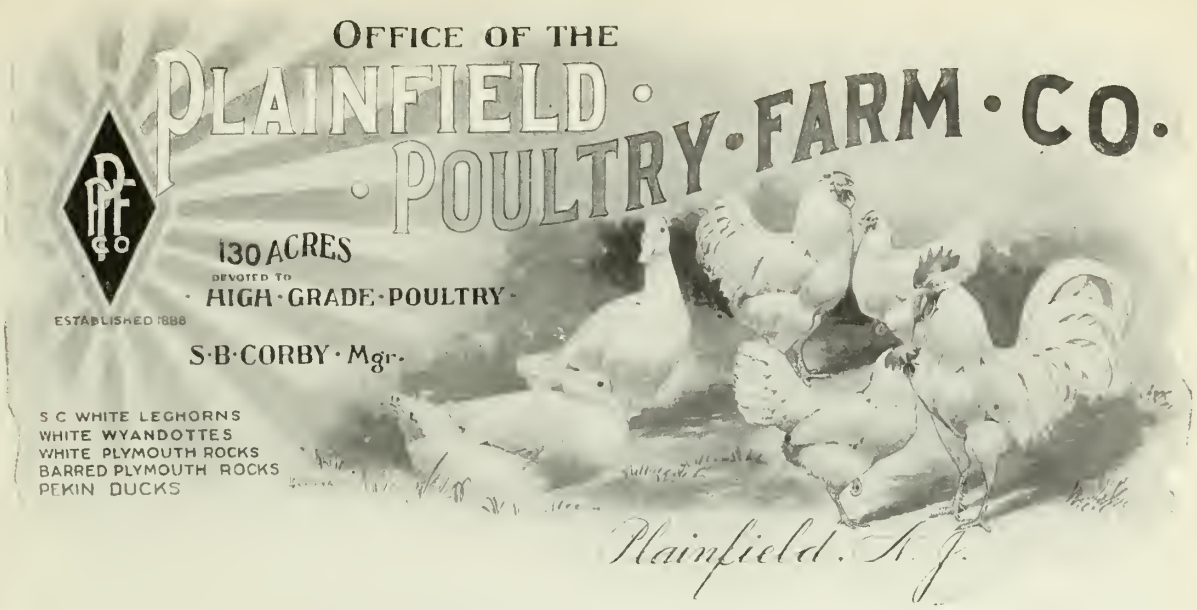
eggs for hatching, 3,000 of which went to one party.

The highest price secured was 38 cents, and the lowest 10 cents per pound. Mr. Huey has kept an accurate account of his expenses, and his eggs cost him last season $1.30 per 100, and the young ducks 4 cents per pound to grow. He has already sold and delivered this fall (September 9th) 260 breeders to one party, and 300 to another. He has now about $5,000 invested in his plant all told, paid for, with the exception of a very little by his poultry business.

He has put in a gasoline engine and mill, and grinds his own corn, so as to have it of suitable coarseness, buying it of the farmers thereabouts, at first cost. His meat scrap he buys of a local rendering establishment, fresh every week, and grinds it with a power "Mann" bone cutter. This was some of the best scrap we have ever seen, sweet and fresh, with but little fat, and just the right coarseness. He can supply a limited amount to the trade.

Mr. Huey's success presents a good picture of what can be accomplished in the poultry business with a very small capital, and a large stock of energy and common sense. It splendidly illustrates the fact that the business can be started in a very diminutive way, growing slowly at first and more rapidly as experience grows, until it is made a well-founded, paying business. Next season it is his intention to add chicken broilers to his duck business. It is but fair to assume that Mr. Huey's success has only begun. We prophesy a great future for him.

YOUNG DUCKS, EXCELSIOR DUCK YARDS.



Oct. 12, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

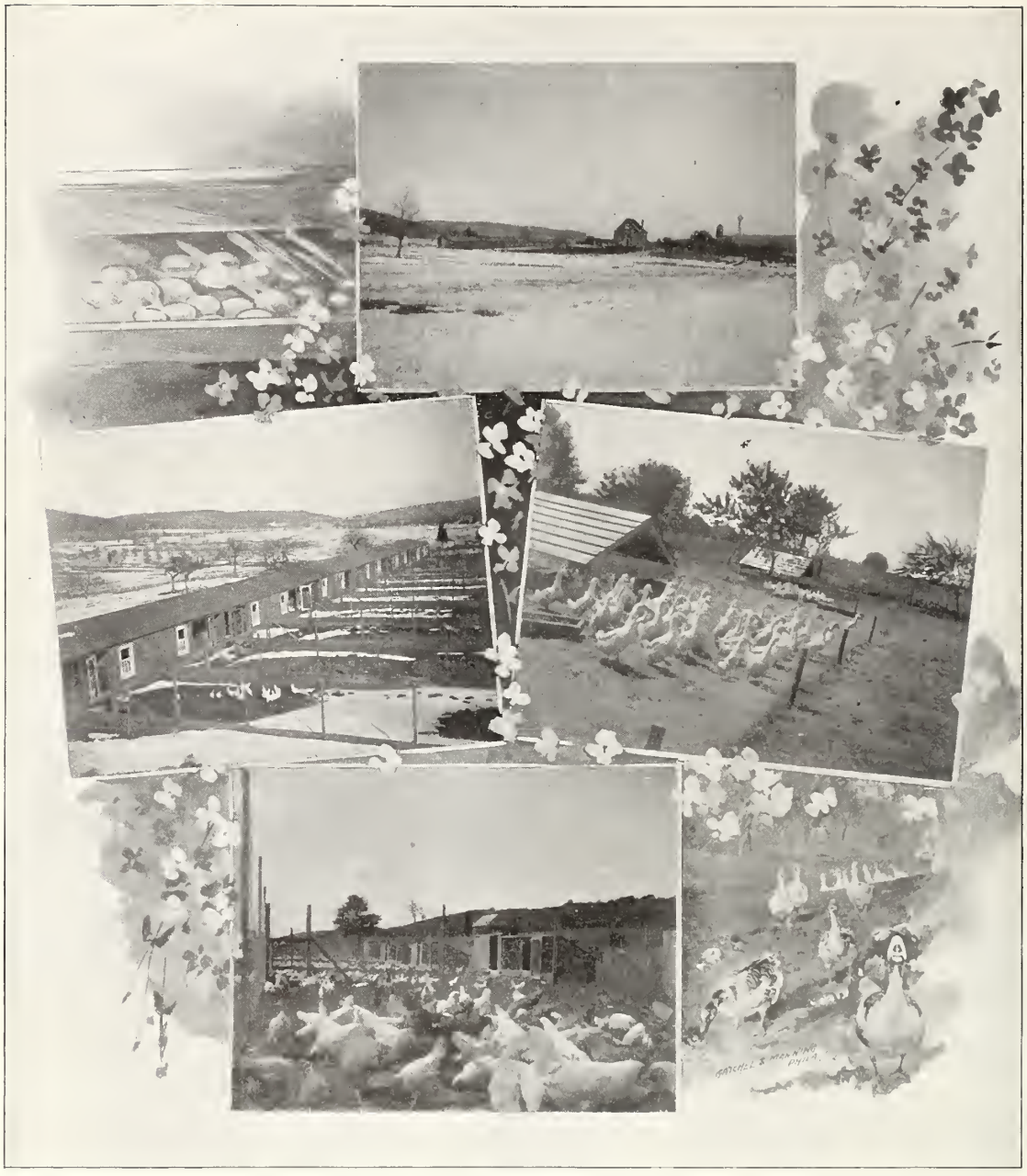
You will without doubt be pleased to learn that over one-half of the thousands of young breeders hatched in your machines last spring have been sold, and the season for selling breeding stock hardly yet open. All of which means we are again going to run short of fowls with which to fill orders, before the winter is over. It also means that we must again increase our capacity in proportion to the great demand for our stock. We are pleased to attribute much of our success in raising our chicks to the strong hatches obtained from the twenty 360 egg Cyphers Incubators used by us last spring, and we therefore call upon you again to furnish twenty (20) additional machines.

Thanking you for the prompt and careful attention given our past orders, we are,

Yours very truly,

PLAINFIELD POULTRY FARM CO.,

S. B. CORBY, Manager.



SCENES ABOUT PLAINFIELD POULTRY FARM.

THE PLAINFIELD POULTRY FARM.

This firm was established in 1888 by Mr. S. B. Corby, who is the manager and part owner. A year ago it was turned into a stock company, since which time the plant has had a lusty growth, and is destined to be one of the great poultry farms of the future.

The farm is located three miles west of Plainfield, a beautiful little city but twenty miles from New York, on the New Jersey Central Railroad. The site is one of the best—on a long southern slope, which is interrupted by a slight depression, and then swells over a broad low ridge upon which the main poultry buildings are located, then falls away again into the valley, where is the duck pond, and just beyond the long duck house. The breeding ducks have access to water

in the lower ends of the long yards, leading down from the duck house.

The poultry buildings already erected, to say nothing of those planned for, indicate the broad

purpose of the company, it being their intention to make the Plainfield Poultry Farm not only a great practical poultry farm, but they also intend to breed the best stock obtainable.

The main laying house is 14 x 240 feet. In addition to this they have fifty small colony houses 6 x 20 feet, a cut of which we reproduce herewith. These small colony houses took our fancy, as they are not only of low cost, but practical The roosting room is 6 x 8 feet, 4 feet in back, and 5 feet front, and the scratching shed 6 x 10 feet, 3 feet in back and 5 feet in front. When we visited the farm in September, these

houses were occupied by pullets, just about ready to lay, but not mated up yet.

Last season their twenty Cyphers Incubators were run in the basement of the main feed house, a

four-story building 30 x 35 feet. This season they erected a long brooder and incubator house combined, 100 feet to be used for a warm nursery, 16 feet in the centre for a heater and testing room, the second story of which is fitted up for a bedroom for the under-manager, who will attend the incubators and nursery chicks. The other 100 feet houses forty 360-egg Cyphers Incubators, they having doubled the number used last season.

SCRATCHING SHED, COLONY HOUSE.

The second brooder, the one used last season, is 14 x 240 feet, and they had a double duck brooder house under way, 33 x 210 feet. It is Mr. Corby's intention to carry over about 1,200 laying hens and 1,000 ducks; the laying house for the latter, situated along-side the pond, being 14 x 365 feet, with a feed house connected 14 x 20 feet. The killing house, two stories 16 x 24 feet, is a model for convenience, containing a large ice chest, cooling room, etc. Their present capacity is about 60,000 chicks and ducklings.

Their orders for stock and eggs the past season were so large that they were compelled to double their capacity this, and from the present indications they will have to enlarge still further next year.

Here is a large farm of over one hundred and thirty acres, being transferred into a great poultry farm for both fancy and utility poultry work. Ample capital is furnished by the stock company which owns it.

It takes time to build up such a poultry plant, but the start thus far is right, and a substantial profit was made last season.

There is money to be made in hatching and raising ducks and producing eggs for market; raising fine breeding stock, and selling eggs for hatching, etc.; and all these various lines of business will be carried on here. Mr. Corby is bringing his years of experience to bear in making this a model poultry farm. They have a great future before them.

PLAINFIELD POULTRY FARM.

MY FIRST PRIZE PEN, BOSTON, '98.

ROSE LAWN POULTRY FARM

ARTHUR G. DUSTON, Proprietor.

* *

WHITE WYANDOTTES

(Specialist Breeder)

MARLBORO, MASS., Oct. 6, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

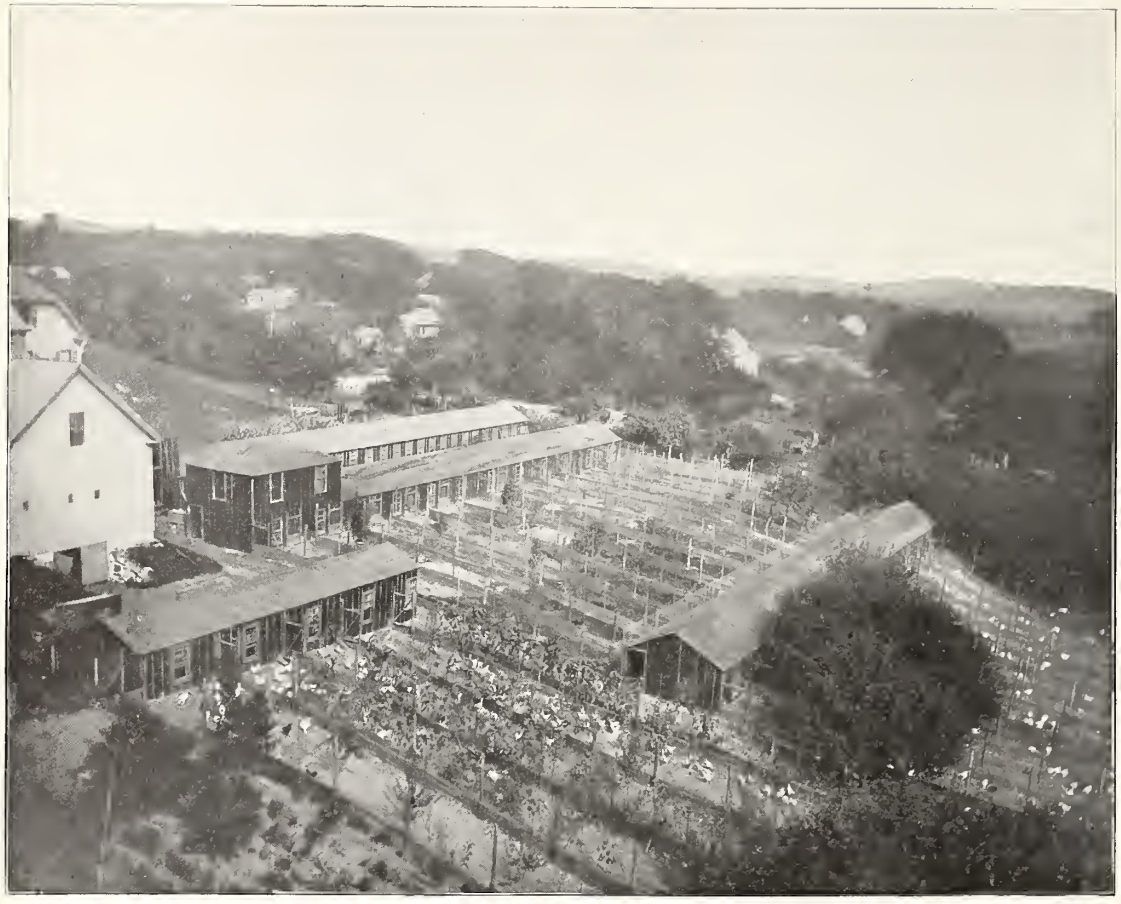
Gentlemen:

During the past six years I have run many makes of incubators with various degrees of success; some have proved entirely worthless, while others have returned fair results. Last winter I purchased and ran two of the Cyphers 200 egg machines for a trial. I am now ready to say I never ran a machine so easy to regulate, or one requiring so little adjusting as yours. The chicks come out LARGE and SMART. I shall probably buy more machines the coming season, and you shall receive the order.

Thanking you for courtesy shown me, I beg to remain,

Yours truly,

ARTHUR G. DUSTON.



ROSE LAWN POULTRY FARM MARLBORO, MASS. ARTHUR G. DUSTON, PROPRIETOR.

We are happy to have among our patrons, Mr. Arthur G. Duston, Marlboro, Mass. Mr. Duston is one of the most successful breeders in the country. After trying nearly all the leading breeds he has finally pinned his faith to the White Wyandottes, and the strain he breeds has been worthy of his selection. Questioned as to how he started in the business, he writes us as follows:

"Some years ago (in 1892) I came in possession of my home just outside of the city of Marlboro. On the farm I had a small hen house of about 6 feet square. I never had done any farm work; never owned or cared anything about hens. I took the house, moved it, and fixed the fence. From a friend I bought six hens and an old cock bird—a mixed lot of what purported to be Barred Plymouth Rocks. These I tended during the winter; got hold of a few poultry papers; attended a show at Worcester, and came down with as severe an attack of "hen fever" as any one ever had. I started a new house some 60 feet long, which I, during the spring, filled with chicks hatched from B. P. Rocks, White Wyandotte, Buff Cochin, Black Langshan and Light Brahmas. During the summer visions of prize winners floated before me, and I might say this is as near to reality as it ever came. I had bought my eggs from a good fellow, but he proved not to be a very successful breeder of more than common stock. During that fall I built me a brooder house 150 feet long; fitted it complete with a good system of hot water; commenced to advertise and to hatch chicks. I hired a good man and put him into the brooder to care for the chicks. I got fair hatches all the winter, and raised a good many broilers, which brought a good price. Most of the early pullets I kept, and during the next summer built me two houses each 150 feet long, stocking them with the pullets. **Getting into shape early in the fall, I started hatching early in December, and I want to say now, that I believe this is THE month for this, for it gives you very early broilers if you want**

tnem, and if price is not up you can hold them for June roasters, and get the good prices paid then, at about only the cost of the food, as you should not have any mortality whatever after broiler size is reached. I raised some beautiful poultry, and got good prices for it. I shipped it all to Boston market. I advertised during the winter all five varieties, and sold a few eggs, but most of them were incubated. I fed very carefully, and had good success raising. My birds laid well; I gathered one month 225 eggs every day from 375 head, males and females. I held onto a part of the best of the pullets, and next year dropped the Cochins and Langshans. That season made a trade with a friend in the poultry business to take all my birds at 18 ounces alive, and all I raised went that way except what were saved for breeders. During the early part of the next winter I sold all my Brahmas, and run the B. P. Rock and White, as I was still advertising and running the brooder. I found that the White Wyandotte was the best bird of the two for me. I did not find much fault with the Barred Rock. The Wyandotte would stand the forcing in brooder, and as layers they were unequalled, the white pin feathers being greatly to their advantage at all stages. Although much money has been, and will be, made on broilers, it is my candid opinion, unless favored with a fine market, you will do as well with roasters, as all of the mortality has to be charged up to the broiler, and no more to the roaster.

"There are very many people of my acquaintance that are making a good living from their poultry. Most of them plan to have a few specimens each year to dispose of for breeding purposes. It costs no more to raise a good bird than one that you would have to sell for 60 cents apiece.

"If asked if there is money to be made from poultry, I say yes. But it means hard, patient work and lots of it. But every man with a true liking for poultry, a little capital, and capable of doing a good day's work, with the determination to keep at it, will get a good living, and is as independent as any person I know of. If you have these qualifications, and the inclination, don't hesitate to venture. I know you will succeed. But if you are inclined to a tired feeling, I say, 'DON'T!!'"

Mr. Duston has been very successful in raising and forcing broilers, and we take the following article from the *Reliable Poultry Journal*, which tells in his own words how he does it:

"We will say that we have decided on the variety that we will run; our eggs are as fresh as possible, and of uniform size; we have put them into a Cyphers Incubator, and with proper care have gotten out a good hatch which came along promptly, so that the morning of the twenty-second day we find the chicks well dried off. We now get our warmed, cloth-lined basket, with a heavy cover or shawl to prevent them getting chilled. Right here I want to say, I believe more chicks 'pass out' as our Christian Science brethren would say, to the land whence no wanderer returns, from getting chilled in moving them from a warm, moist incubator on a cold day into the brooder than most folks are aware of, and those little fellows you had such fond hopes of, but lost last winter with what you called bowel trouble or diarrhœa, were really chilled in being changed from birthplace to their temporary home.

"Well, we have got them safely, we hope, into the brooder, which has been brought up to the temperature of the incubator. Of course we have placed our board in slides about a foot outside of hover, so that the babies cannot get out in the long pen and not be able to find the way back, and thus get chilled. Just bear in mind for the first week that to keep them *warm* is more essential than food.

"The first day of their lives in a brooder has almost passed, and they have not eaten anything but *sand*. Night has begun to come on and it is time to feed the hens, but, let us first scatter down for the babes a liberal supply of rolled oats, the white flakes of which will instantly attract them, and they are left to themselves. In the evening, as we fix the fire preparatory to locking up for the night, we look at them and are pleased to find them scattered all over the hover bottom, and their contented little 'peep' is the last sound to fill our ears as we go out, and our mind is already filled with visions of juicy broilers and big-breasted roasters and the perquisites thereunto attached.

"The next morning as we turn out at daylight to see our orphans we find them calling for breakfast. We touch up the fire and then a feed of rolled oats is given them with a dish of warmed skimmed milk. We use an old fruit can for this purpose with a notch cut in the edge. Partially filled with the milk and inverted into a saucer, this makes an elegant fountain for small chicks. A saucer not much larger than the can is best, then the chicks will not get 'stuck up.' The milk on the down will stick them together as bad as paste would. Some of the little fellows that

would not eat will drink, so you save them along until they will eat.

"That you will save more chicks by giving them warmed skimmed milk than by any other system of feeding grain, is my way of thinking.

"We next powder some charcoal in a mill and this is put into a dish and set in for the chicks to eat. We have found this an excellent regulator for very young chicks, as well as older birds.

"We are now going to feed every two hours until our young charges are turned over to the butcher. Let it be done by the clock; you will then be more regular and can more easily even up the day.

"For the first week you are limited to rolled oats, millet seed (which is a semi-green feed) and cracked corn, run through a Willson mill to make it fine enough, then sifted to save the meal, which of course, is wasted by throwing it on the ground. We have kept our milk before them *all* the time and have carefully washed the dishes *twice* a day, noon and night, as nothing gets any more filthy than do these dishes if left uncleaned, the fat of the milk, dirt and droppings all adding their mite to make it so, more especially as the chicks get older. Some think skimmed milk expensive to feed, but after trying it you will be convinced that the increased growth that comes from feeding it, gives you a good profit on it, and this is what we should always think of when weighing the cost of food. The real question is, can I get enough quicker growth by using it and give me a profit on it? For feeding choice 'fancy' chicks I have heard it contended that whole milk was cheap to feed. I have been able to buy all the skimmed milk I want for 5 cents a can, of 8½ quarts to a can, and have used as high as twenty-six cans a day for broilers and roasters.

"As we have put into each hover about one hundred chicks, we must see that the sand is carefully scraped off the top as often as necessary, probably twice the first week, which will be increased each week until about the third, then we commence to clean them regularly every morning. We run the wheelbarrow into the walk, lift the hover, which is hinged against the partition so it is easy to get at. We take a small dust pan, or, if you prefer, make a scraper, by driving nails through a stick something like a rake, only close together. Then scrape or rake the *top* off, going quickly from one to another.

"For the first week we keep the board in the slides just forward of the hover, as stated before. Now the second week we will remove it and keep an eye on the chicks to see that they do not get lost and by staying away from the fire too long get chilled.

"For this week we will feed about the same, only perhaps it will be well to try them on a little mash made up of one-third corn meal and two-thirds wheat bran, seasoned with salt and red pepper, just the same as though we were to eat it ourselves. Mix well and add boiling water. *Don't* put in enough to make it *sloppy*. Allow it to stand a short time, then feed. Not much will be eaten, but they will get so before the end of the week they will look for it, as you feed your soft and hard grains alternately.

"The third week we always settle down to our regular routine, to be continued until about ready to market. During the second week we have cracked some wheat in our mill, so have had that for an extra dish and a change, giving corn as a last feed generally. A good many feed cut or pin-head oat meal to little chicks. This we have found to be a trifle pasty or gummy, and have dropped it, as more will get stuck up around the vent when this is fed than when not.

"There is one thing that is absolutely imperative—that is, *to get your chicks out on the ground.* If it is bright and warm put them out for a few minutes when a week old. Don't let them stand 'humped' up and shiver, but make them hustle around by driving or feeding a handful of millet seed. After the second week they must go out *every* day unless it storms, *no matter if it is zero weather.* After you have tried it you will see how essential it is, for you will not keep them *on their legs* under such high feed in any other way.

"As we enter upon the duties of the third week we will now get our routine started, and will see the chicks push along for the next five weeks, at which time we hope to see two pound birds ready for the market, and get sight of the returns for our labor. The first thing in the morning is a feed of hard grain; then comes a feed of chopped raw potatoes. As the chopping knife and tray were too slow, we got an Enterprise mince-meat chopper, had a new disc made with larger holes, about three-eighths inch in diameter, and run the potatoes through that, catching in a pan the first and last to come out, as it is nothing but water. The other is the pulp. Now take their feed dish and give each pen all they will eat. A little later we throw in a little cabbage, cut in strips, which they will seize and chase each other around for until it is all eaten.

"This constitutes all the green food they have, except once in a while we may substitute

onions in place of cabbage. We have gotten our mash made for the day, and as 9 o'clock has come we will feed our first feed of it for the day, only feeding what they will eat *quickly*. We feed on tin plates, about fourteen inches in diameter and a quarter of an inch deep, with a wide fold at the top. These can be readily cleaned preparatory to another feed by scraping with the feeding shovel, which is a small shovel about four inches across, made of heavy sheet iron and a white iron handle. We have a pan to put the leavings in, if any. They go into the swill for the pigs. At 11 o'clock another mash, then the dishes are picked up, taken into the kitchen or cook room and washed.

"Again at 1 and 3 o'clock we feed the mash, and if we have used good judgment we have had a hungry mob each feeding. If we have been liberal, we find they have left something each time and are not ready for their feed. When this is so, just scant them until they clean up each time and do it *quickly*, taking care you have enough for all. You will find the number of plates will have to be increased as the chicks increase in size, in order that each may have a chance. At 5 o'clock, or before dark, throw down a liberal feed of cracked corn.

"We follow this bill of fare for about four weeks. As we have crowded the chicks pretty well by putting 100 in a pen, *we must take extra precautions against filth*. At about four weeks of age a day's droppings is considerable on the floor of the pen, so the floor is now raked over each day and the collections wheeled out. For this we must use a loop-toothed rake.

"We have by this time found our fountains small and easily tipped over by the chicks, so we have adopted new ones holding nearly two quarts, made of galvanized iron and cone-shaped on top, to keep the youngsters from roosting on them, and instead of the saucer we use a small, deep agate pan, only a trifle larger than the fount. This we find to be very satisfactory, as the chicks cannot put their feet in it.

"To come back to the six- or eight-weeks old chicks. We must now think of finishing them off. We examine them, weigh a few, calculate how much flesh can be made on them in about ten days, for as broilers Boston has no use for anything over four pounds to the pair. We have fed so much bran that as we lay back the feathers on the breast we say, 'they ought to have more color.' How can we get it? We cast about for a way to get this. We know corn will do it, but we lose time if we drop off from soft feed to hard. The chicks won't grow as fast and we must turn them off as soon as possible to get the most profit from them. So we put into the mash all the cotton seed meal we can stir in and not make it 'salvy' or 'puddingy' as we call it. With a little treacle added we have accomplished the result.

"We now have a fine yellow skin, if we have not foolishly chosen a blue-blooded carcass, but any yellow-legged variety will succumb to the treatment. I would caution you against trying to feed this for too long a time, say more than two weeks, as the chicks will get clogged of it, and you cannot hold their flesh, to say nothing of making any, unless you can keep their appetites 'up to the clip.' This being such a high feed, it seems to become nauseous to them. One would find it difficult to keep them on their legs if it was fed from the first.

"We have now 'forced' the birds for eight weeks, and have obtained what we set out for, viz.: Two-pound broilers at eight weeks.

"This has been successfully accomplished on our farm here, with White Wyandottes. We have not done quite as well with any other variety. They will stand on their legs where Plymouth Rocks would be rolling on their sides with the same feed.

"We put up two pens of 110 each, and at eight weeks they weighed two pounds each, and a portion two and one-quarter pounds each under this system of feeding and almost the same treatment. By continuing the regular feed we have made five and five-eighths pound roasters at fifteen weeks old.

"One thing more before closing: If you ship your poultry to market alive, and it travels twenty to thirty miles on the railroad, feed the night before, not too heavy, but some, as the birds will empty themselves in the night and on the journey. Give them *all* the *water* they will drink before they start on their funeral ride. You will thus save a portion of your shrinkage to nobody's injury, but to their gain, I believe, as you help retain the juiciness of the flesh.

"Some of these hints have been gained in the expensive school of experience, but if any earnest, honest poulryman can get anything of assistance from them he is welcome. As one word of caution, do not attempt to raise your breeding females under such hot-house methods, because you will sacrifice your size through early maturity, as, after a period of forcing as given above, it is no uncommon thing for pullets to lay at sixteen weeks, and we all know that is enough to stop growth. You

may start your breeders in the brooder, holding off forcing fowls, but get them out as quickly as possible.

"The summing up of the discussion is, breed, feed and care. Let us not disdain to use the breed because it may be bred to 'fancy points,' as the fancy has given us our best and most practical varieties, and the nearer a typical bird we have of almost any breed, the better carcass we have."

BROOKSIDE POULTRY FARM.

J. E. STEVENSON, PROPRIETOR, COLUMBUS, N. J.

Mr. Stevenson is quite an old New Jersey breeder, and makes a specialty of White Wyandottes, Black Minorcas and Pekin Ducks. He has 160 acres on which to raise good, vigorous breeders, and in a quiet, unassuming way does considerable business in selling eggs for hatching and stock for breeders, exhibition, etc. He also grinds his own meat scraps, and can supply a limited amount to the trade.

Brookside Poultry Farm

WHITE WYANDOTTES.
BLACK MINORCAS.
PEKIN DUCKS.

J. E. STEVENSON, Propr.

SELECTED BREEDING STOCK, OR EXHIBITION BIRDS
THAT WIN, AT REASONABLE PRICES.

Eggs that Hatch in Season. Satisfaction Guaranteed.

Columbus, N. J., Sept. 26, *1898*.

THE CYPHERS INCUBATOR CO.

Dear Sirs:

The sixteen No. 3 machines purchased of you have given excellent satisfaction. I have been using incubators for the last ten years, and in that time have used nine different kinds of the leading makes, and in none of them have I had as good results as in The Cyphers, either in the percentage of chicks and ducks hatched, or quality, they coming out so clean and strong. In short, I would have been much better off had I your machines a few years sooner.

Yours very truly,

J. E. STEVENSON.

C. BRICAULT, M.D.V.,
VETERINARY : SURGEON,
P. O. BOX 68,
TELEPHONE CONNECTIONS.

Lawrence, Mass., Sept. 10, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

I don't believe there has ever been a better machine made than the Cyphers Incubator, and I doubt if there ever will be. I am now using three large size, and have made 19 hatches with them. The lowest number of chicks I took out of one machine was 252, and the largest was 316 out of 360 eggs put in. I don't believe there is a machine in existence that can beat that, and this was done with winter eggs mostly.

I am a firm believer in your incubator and have advocated it to everyone who comes here. It is so easily managed that any beginner can operate it from the first. One of its greatest points is its even temperature; my machines did not vary one degree all the time they were in operation. The fact that the ventilation is perfect, coupled to the even temperature which the regulator maintains, and that there is no bother with moisture, is, in my opinion, almost perfection in artificial incubation. I got more chickens out of one of your machines than I ever did out of a 600 egg ------, and such strong, lively chicks, it did my heart good.

Very truly yours,

C. BRICAULT, M.D.V.

BRICAULT PLANT, LAWRENCE, MASS.

Dr. Bricault is a very enthusiastic and successful poultryman. His earlier life was spent in college and university until he located in Lawrence some twelve years ago, since which time he has built up a very good practice in veterinary surgery.

About four years ago he purchased a small farm on the borders of the city, and devoted it exclusively to breeding "Bricault's bred-to-lay White Wyandottes." He is working for a brown egg strain that will give him 200 eggs a year, using nothing but standard weight breeders. Dr. Bricault expects to accomplish this within two or three years by the use of an automatic nest box in each pen and keeping a record of every hen on the farm. This season he keeps over 450 pullets, all bred from his best layers of brown eggs.

The laying houses are built on the scratching shed plan, and are put up in the best possible manner. The grain room contains all the new up-to-date machines, such as Man's new bone cutter, clover cutter, root cutter, set boilers, grain mills, etc., all power machines being run by an electric motor.

Dr. Bricault gives special attention to fertility of eggs, as he intends hatching a large number of broilers and roasters. He raises his breeders in individual brooder houses, in which he places a small lamp brooder, giving the chicks the range of the farm. He puts vigor first on the list for selection, then egg-laying capacity and weight.

Dr. Bricault mates for higher fertility and feeds for the largest number of eggs. A concentrated morning mash is fed containing cut clover, green bone, etc., vegetables at noon and plenty of good, sound grain at night. Fresh running water and clean quarters add to the health of his birds.

The Doctor is a live, energetic up-to-date breeder, and he is bound to make a good financial success of the business.

Some Prizes Won on Pekin Ducks.

1898.

New York Show

6 ENTRIES.

Duck	1st	2d	3d
Drake	1st	2d	3d

1897.

Boston

Old Drakes	1st	4th	5th
Old Ducks	1st	3d	4th
Young Drakes	2d		3d
" Ducks	2d		3d
Exhibition Yds.	1st		2d

Specials
Best Duck
Best Drake
Best Exhibition Pen
Largest Exhibit Pekins

Best Collection, - 45 pts.
Nearest Competitor, - 26 pts.

Hagerstown, Md.

All the Premiums in the Pekin Class.

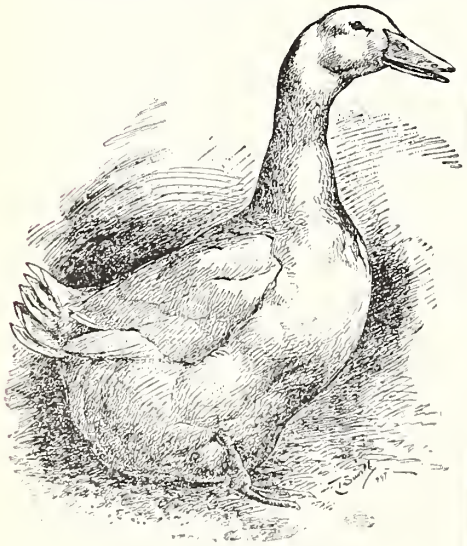
R. I. State Fair.

A Clean Sweep.

R. I. P. Association.

PAWTUCKET, R. I.

15 Regular and 8 Special Prizes on 16 entries, losing 4th on Old Drake.



1st and Special Boston, 1897.

Pollard's Poultry Farm.

1st and Special Boston, 1897.

PEKIN DUCKS. WHITE WYANDOTTES.
EMBDEN GEESE. WHITE P. ROCKS.

South Attleboro, Mass., June 1, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Dear Sirs:

After a thorough trial of your incubators on both hen and duck eggs, I am prepared to give them an unqualified endorsement, and to recommend them to inexperienced operators as being almost entirely self-regulating. We fill the lamps and the machines do the rest.

Yours truly,

GEORGE H. POLLARD.

GEORGE H. POLLARD'S FARM, SOUTH ATTLEBORO, MASS.

George H. Pollard, of South Attleboro, Mass., is in the poultry business for profit and gets a bigger share of it than most men would think possible. It is an intensely interesting study to go over the experience of a practical man such as Pollard, and note the steady growth of his business, which, from an almost insignificant beginning has assumed vast proportions. Mr. Pollard is a poultryman, and not even a cow is to be found on his farm, because a cow is neither a duck nor a hen.

In the Pollard poultry plant Mr. Pollard has embodied original ideas and success has demonstrated the value of them. His incubator cellar can take care of 20 incubators. It is now partly filled with Cyphers Incubators.

On a small plateau extending back from the farm buildings is a long hot-water-pipe brooder house for ducklings and chicks, the eastern two-thirds of the house being arranged for ducklings, and the western third for chicks. On the eastern edge of this plateau are located several isolated scratching shed houses for pens of breeding stock. They are so situated, just down from the top of the plateau, that they are sheltered from the north and west winds, and as about two-thirds of the height of the walls is stonework laid up in cement, they are delightfully snug and warm for winter shelter. Mr. Pollard said that the warm sun shining in there warmed up the stonework so that for a considerable time after the sun had got along towards the west the open front sheds were appreciably warm, and that he "got lots of eggs from the birds so sheltered." The roosting part of these houses is a very small lean-to shed, which can be closed up snug and warm in winter, and in summer is only used for nests for layers, the roosts being taken out and a roost pole for summer use being placed upon posts towards the back of the open shed. This reduces the work to a minimum, as there is no cleaning of roost platforms in summer, the droppings being allowed to fall on dry gravel beneath the perches, and as the moisture is quickly evaporated in that extremely dry situation, there is no trouble from leaving them until the gravel is cleaned out and a fresh supply put in for the next generation of layers. The yards for these houses are quite ample, extending down the slope and across the low land of the bottom. Mr. Pollard said that this spring, very much to his surprise, he found some of his youngsters dying off—would find three or four at a time packed into a corner of a hover, and upon examining them found their legs were all shriveled up, indicating that their location was too dry for such a dry time. He got over the difficulty

by wetting down the hay chaff on the floor of the brooder pens with about three or four quarts of water every morning, and the chickens working about in that, their legs got the moisture needed.

The long brooder house is built with the hot-water pipes beneath the hover floors, the air being admitted to the hovers through two 2-inch pipes reaching up about 5 inches above the hover floors, and coming to within 1 inch, perhaps, of the hovers themselves, the warmed air from beneath flowing up through the pipes and being deflected over upon the chicks' backs by the hovers.

The chicks are kept in the brooder house for about four weeks, then moved out to small coops scattered about in convenient localities, and when eight or ten weeks old are moved out into some large yards of about one-third of an acre each, and colonized in roosting coops. These yards are long and narrow, being arranged 150 to 170 feet long by about 30 wide, the coops being set along the end abutting upon a roadway along which the horse can draw the food and water to supply them. They can range at will within the limits of these long yards, but have to come down to the coops for their three meals a day or their water to drink, and, of course, come to the coops at night to sleep.

Mr. Pollard has pretty much given up raising ducks for market, using only the choicest stock for breeding, and sending to market only the culls raised from them, the bulk of the birds raised being for breeding stock and to supply his numerous orders. He wintered about 500 laying ducks, and is raising about 3,000 youngsters, and he has about 1,500 head of chicks, White Wyandottes and White P. Rocks. Mr. Pollard breeds for a practical fowl, therefore wants rich yellow skin and legs, and he gets it. He wants the short legged, chunky bird, and breeds for those qualities. He wants, also, prolific layers and layers of dark brown eggs, and he aims to couple with those qualities the points which win in the show room.

During the past summer a cook house has been erected on the farm, so arranged that the feed can be unloaded into the second story, spouts conveying it into the mixing troughs below. A windmill pumps water to a tank on the edge of the plateau, and this is piped to various parts of the plant along the fronts of the yards of the brooder house, so that opening a cock at the further end will supply every pen with water.

Through the courtesy of the *Reliable Poultry Journal* (to whom all rights to this article belong) and Mr. Pollard himself, we are permitted to give the history of Mr. Pollard's experience in the poultry business, as written by him for that paper for the November issue. Mr. Pollard says:

The story of how a person got into the poultry business is often quite as important as how he stays in. On the mode of entrance depends largely whether or not he does stay in, and his success or failure. For these reasons we propose to give a plain, unvarnished tale of our everyday experiences, of our faults and failures, our ups and downs, and something of the success which is the outcome of our trials. In either direction these will prove nothing wonderful, and thus will be more helpful than a book of hints, intelligible only to those who possess either great genius or the gift of second-sight.

Having for several years secured more or less of a stopping-place, and an occasional indulgence in food and raiment, by dealing in poultry, buying and dressing it for the market, it came about that a few ducks were ordered with a lot of poultry as a trial. They were the veriest scrubs, and were covered with black hair and pin feathers. Nevertheless they sold at a fair profit. We at once began to cast about for a better looking article to sell. About midway between our place and the market, where we sold considerable poultry there had recently been started a duck farm by a man who had read of the fabulous profit to be made from one bird. He began with hens and intended a plant for egg production only, but the Monte Cristo stories of some of the Pekin pioneers fired him with an ambition to win some of the surplus wealth promised to those who believed and bought that stock. At that period, so little while ago as 1890, ducks were almost an unknown product in Providence, R. I., a city with its surrounding outposts, of nearly or quite 200,000 population, and of large wealth, a numerous well-to-do class, and expensive and up-to date markets. By paying a cent or more per pound, we were able to have the choicest of these ducks saved for our trade, and each Tuesday and Friday, when on our way to market with fowls and chickens, we would stop and take aboard the ducks previously ordered. So different were the market conditions then than now, that while ducks were selling in the Boston market for 18 to 20 cents per pound, we were generally able to get 28 to 30 cents for the first lots we carried in. Our books show one lot of 280 pounds, on which we cleared $28. Our regular profit was 4 cents above the Boston and New York prices, and it tasted good.

Our producer being in poor health, and unable to bear the nervous strain of such a rapid money-making business as duck raising was reputed to be, made us a proposition to sell the plant and let us have all the profit. Being unused to handling large sums of money, this looked to us like the chance of a lifetime. Our after-experience proved we were not mistaken, but we got it in a different sense than we expected. Through some lively hustling and the aid of kind friends we were enabled to grasp the opportunity and begin the struggle to hold on to it. With the outfit we had four large sized incubators, and about 180 Pekin ducks, together with the necessary feed troughs, tools, etc., with houses and two acres of land. We grappled the business the first of November and began the wrestle. Having a small wholesale poultry business in a nearby city we had a man who lived near come a part of every day and feed and water the breeders.

GEORGE H. POLLARD'S PLANT.

Our instructor in the business told us the scalded food was the proper thing. He had learned it out of a little book whose writer fed his unscalded. We scalded the food. A variety of grains were necessary and the grain room was lined with sugar barrels holding meal, bran, shorts, fine feed-ship-stuff, corn, cracked corn, oats, wheat, beef scraps, charcoal and such other little delicacies as might tempt the feeble appetite of a duck. Feeds were figured down to percentages and we had to study arithmetic all over to learn what the ducks should have for supper and tackle algebra to mix a proper breakfast. This was not the fault of our teacher, but was about the type of the general instructions for the feeding of poultry and it is not yet all done away with in some quarters. They were kept in a house built for hens and fashioned on somewhat eccentric plans. It was two stories in height, but only the ground floor was used for poultry. Both sides slanted toward the roof. The floor space measured 15 x 160 feet and there was a central aisle and raised footway the entire length. The ducks ran back and forth under the walk. It is always a mistake to have slanting sides to a poultry building. In warm weather they are too hot and there is always a leak somewhere. This building

was covered with three-ply felt roofing and washed with tar. The beating rays of the sun on the slanting south side had made a course of shingles our first operation. Our directions said to feed and water inside in winter as ducks' feet feel the cold and when they are cold they prevent laying —resembling in this respect a hen's comb. It seemed to us the Creator must have made a mistake in putting the tenderest part of a duck in the coldest place, but we were not sure. So we kept the birds shut in to keep their feet warm. Planer shavings were used for bedding or litter. Pleasant days when there was not much snow on the ground we put on their boots and wraps and let them out for a little fresh air. We stayed in the house and forked over several tons of wet shavings and tried to dry things up. It is a great wonder how far a duck will make a little water go in wetting up a house. The shavings were renewed frequently and so was the water and the two kept about evenly moist. We fed mornings a mixture of as many kinds of grain as we had and with a liberal proportion of cut clover, or we boiled a part of the 80 bushels of unmarketable turnips we were led into buying, and used this instead of the clover. At noon they had a ration of cracked corn, oats and wheat carefully measured and mixed in equal parts and occasionally green cabbage. At night more soft food. As often as we could get any spare time we figured up how many ducks we could hatch from the number of eggs we would get and how we should manage to house them all.

From time to time we found a dead duck, but consoled ourselves with the thought that there would be more room for the others. The ducks began laying the fore part of December and the eggs drizzled along as early eggs do, till at last came the fateful moment, February 2d, when we were filling the first machine with 411 eggs. We fixed up a scientific card for marking the variations of the temperature, the weather conditions, direction of the wind and the phase of the moon, and such other data as are necessary for amateur incubator hatching. The fifth day we tested the eggs and found we had 30 per cent. fertile, and we managed to hatch 78 out of the 111 left in the machine. It goes without saying that they were a wonderful sight. First hatches are generally much like new babies, small but very interesting. We had followed instructions and put in one pan of moisture on starting eggs, one on fifth day, one on tenth day and the four on sixteenth day. All this with regard to mathematics but without reference to outside conditions. For the benefit of beginners we may add that some died in the shell.

Our second hatch was 134 out of 471 eggs. Some died after pipping the shell. Some before. Third hatch was 165 out of 520 eggs. About 100 died after pipping, and we still had the four pans of water. The books said so. The hatches grew steadily worse, and the ducklings correspondingly weaker. A great many saw with one eye and walked with one leg. We asked the authorities, and found that our food was too hot, and that it was too cold; we fed too much meal, and too little meal; we did not ventilate enough, and they had too much air; we ought not to give them too much grit, and we must be sure to give them plenty; we must keep the house warm, and again it should not be very warm for ducks. They felt sure the temperature in the machine was too high or too low, and the ventilation was both ways. We did not find one who put the trouble where it belonged—in the eggs—and, back of that, in the breeding stock.

The birds had been bred for several seasons in the same shut-in way we had begun—that is, in small yards with no exercise in winter. All the fresh blood introduced was a few drakes each season, bought from the same source, and the inevitable result was that, while there was a fair response in eggs, the stamina and vitality were lacking. We pulled through the season, and at the end realized the fact that we did not know anything; we likewise found there were others not far from the same location. After considerable thought, we decided the fault was in the stock, and determined to let them have a vacation. Not having the land room ourselves, we put them on a ten-acre lot, through which ran a clear brook of some depth and width, and let them stay in the bush and water from August till November, feeding once a day all the whole corn they would eat. In November, when brought back, the ducks were the picture of wide-awake, healthy birds, strong on their feet, with deep, strong color in legs and bills. They were mated up with five ducks to one drake, and the usual routine of inside feeding began, but with a less variety of grain. Laying began in December, and about February 1st the machines were started. The eggs came fairly fertile, but did not hatch well, the first part of the season leading and then running steadily lower in percentage of fertility. That year they got as low as 70 chicks hatched from a full machine of eggs, 450 to 500, and naturally, as is always the case, poor hatches meant a high death-rate.

We were sadly shaken in our estimate of the duck business and the figures put out by some of the experts. We tried to think, but it is hard work to reason with a cyclone back of one and a dead sea in front. After we finally came to, we decided we did not yet know it all, but had found out that we were wasting our time with poor stock as breeders. When the battle was over, only the dried feathers in our feather loft and swollen grain bills were left. We had all the experience we could afford, but not enough to satisfy us.

They were fed what they would eat clean, whether a pint or a peck, and no more. They had drinking water at all times when the temperature was above freezing and only at feeding time when below. In cold weather the food was scalded and fed slightly warm; in warm weather it was fed cold. The result was that, while we got a slightly less egg yield, we got better fertility. We had good hatches. The ducklings were strong and lively. We lost less old birds and had less cripples. The hatches were good and the death-rate low every time when properly managed. When

GEORGE H. POLLARD'S PLANT.

We got together another flock, avoiding as much as possible all blood nearly related to the blood lines of our first flock, and began again. We stopped the fussy care, and fed and watered them out of doors, storm or shine. We cut off all the fancy variety of food, and gave them only a mixed feed of wheat, bran and meal, with beef scraps, and stopped the noon feed of grain, giving in its place chopped cabbage. They were let out on the snow and into the snow water. We encouraged all the outdoor exercise possible. There was no pampering and no mathematics. the season ended we felt that we had learned a little.

We knew for a fact that we could get good hatches with very little moisture, and that our breeders did not need mufflers and rubber boots. We had also learned that we could dispense with a professional cook and feed only simple, plain foods with good results, but we had not mastered it all. The next year we added fresh blood from non-related stock and tried to get larger and fresher runs for the breeding stock. We began to feed more meat and to force the laying, thus

getting earlier eggs and more of them. Things looked promising and we began to revise the $40-a-duck yarn and locate our savings bank. It did not come. We got early eggs, but the fertility was poor and the hatches were not good. The young lived far better than was to be expected from the condition of the hatching, and we were not running very fast in either direction. The savings bank was just out of sight, around another corner, with a bill collector in the foreground.

Still dissatisfied and with weakened faith in the business, but determined to hold our grip if possible, we looked about for a farm where we could get running water and grass range for our breeding ducks. We knew our Pekins could not and would not go into the water, for the authorities said so; still, we wanted to see what they would do. We found our present location and started our plant by building a house for the breeders as shown in the cut herewith. The ducks were allowed long yards and swimming pools, were out in all seasons and weather, were given less scraps and were fed outside at all times except when a storm might be too heavy. The house was of the simplest shape and style.

The eggs were gathered and carried in wagons five miles over rough roads to our home place for hatching. The result was the *5,000 ducks and 800 chickens on two acres of land*, which went over the country in all the leading poultry and farm papers.

Our success was not alone in the market line, as at the leading shows of that year our Pekins began to loom up as the true practical type, winning a large share of premiums at Boston over the leading breeders in the largest show held up to that time in the United States.

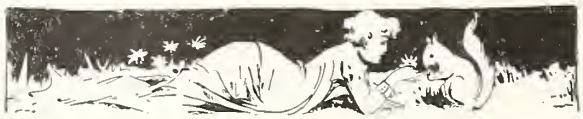
Our subsequent experience has taught us the value of water for breeding ducks and the need of careful introduction of fresh blood.

To produce strong, healthy ducklings we must have vigorous, hardy breeding ducks that have been selected and fed to that end, and not, as is so often the case, merely chosen from a haphazard lot of forced market birds and thrown out as being good enough for breeders.

We believe there will be developed a demand for breeding birds from strong, vigorous stock, bred under fairly natural conditions and fed and cared for in such a manner that they will come to maturity without undue stimulation, with constitutions and condition unimpaired by close confinement, heavy, forced feeding and the wholly unnatural surroundings of birds fed and grown for market.

In many instances we hear of a failure to hatch eggs and raise young Pekin ducks. When traced to the source, we find that, in a large majority of cases, these breeders have been too careless in introducing fresh blood, being governed more by convenience and price than by the vitality and vigor and the conditions under which the fresh stock has been developed. There is no question that large numbers of ducks can be raised successfully from land yarded stock, and the business profitably conducted, but the further we get from natural conditions, away from the swimming pool and the grass range, the greater chance we run of infertile eggs and debilitated breeding stock. So firm is our belief in this truth that we have abandoned the raising of market ducks, and in future shall cater only to the demand for choice breeding stock, carefully bred and mated to produce hardy, vigorous breeding birds to supply fresh infusions of natural strength to breeders who have not the land and water facilities for profitably conducting such operations.

The time is here when careless and shiftless methods will not do. Breeders must give attention to the fudamental requirements of the business or stop. The market for both live and dressed poultry becomes every year more critical and exacting. Stock which a decade ago would please, now fails to suit. While medium or poor stock sells at some price, the profitable demand is only for the best. GEORGE H. POLLARD.



James F. Clark,

Choice New York Hops,

Poultry and Fresh Eggs.

Cooperstown, N. Y., Sept. 24, 1898.

THE CYPHERS INCUBATOR CO.

Gentlemen:

The nine incubators I bought of you last fall have given the most complete satisfaction, as my new order for nine more this fall is the very best evidence.

Last winter I ran your nine machines in the same room with three other makes of machines, and they were all filled with eggs from the same pens. In every single hatch your machines, each and every one, hatched a much larger percentage of chicks than either of the others, and the others were all good first-class machines too. I can't say any too much in favor of your machines.

Yours truly,

JAMES F. CLARK.

SEELY & SONS,

. . . PROPAGATORS OF . . .

Mammoth Imperial Pekin Ducks.

GOOD STOCK AT REASONABLE PRICES.

Our book, "Modern Duck Culture," sent free . . . . .

Cedar Rapids, Iowa, Sept. 27, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

We are thoroughly convinced, after several years' experience, that of all the various makes of incubators we have operated, the CYPHERS only is worthy.

We consider it a strictly first-class, practical, and reliable machine, and, so far as we are able to judge, it has no equal in any respect.

The regulation is very accurate, and our machines run the entire hatch without the slightest variation in temperature.

Mr. Cyphers' method of ventilation by diffusion more nearly approaches the natural method of incubation than others, and, as a result, the young are always hatched strong and vigorous.

It is certainly a very substantial, well-constructed incubator, planned on scientific principles and built for business.

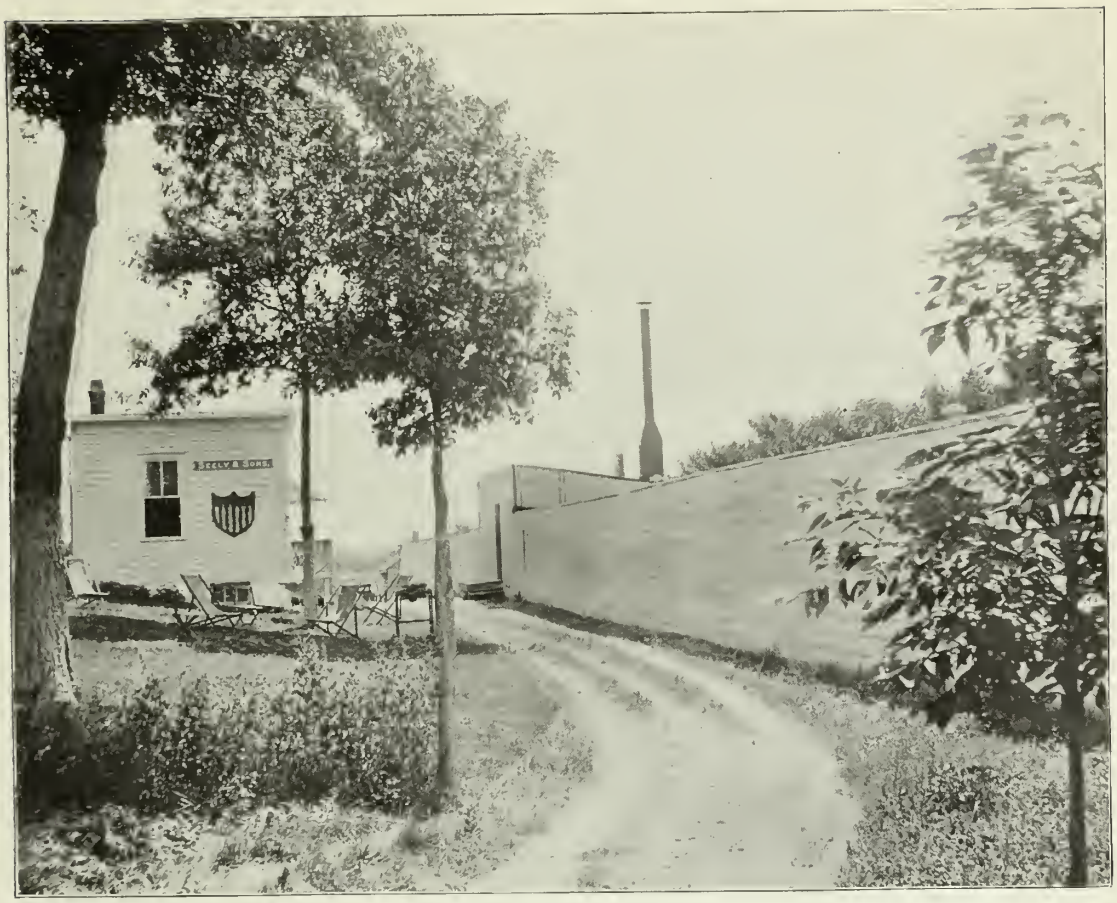
It possesses innumerable points of merit that the operator must see in order to appreciate.

The incubator throughout shows evidence of being designed by a master hand and one thoroughly acquainted with the natural laws of incubation.

As evidence of our appreciation of a more substantial nature, will say that we expect to order twelve or fifteen more CYPHERS this Fall.

Yours truly,

SEELY & SONS.



SEELY & SONS, CEDAR RAPIDS, IO.

One of the leading duck ranches of the West is that of Messrs. Seely & Sons.

It embraces 40 acres of rolling and well shaded land on the eastern city limits of Cedar Rapids, Iowa ; and is an ideal tract of land for the duck business. About 15 acres are devoted to houses and yards for the propagation of Mammoth Imperial Pekin Ducks, exclusively. The balance of the farm is used for growing feed for the ducks, such as clover, rye, vegetables, etc. The plant throughout is substantially built and equipped with all modern improvements necessary to conduct a first-class industry of this kind.

The floor space of the buildings aggregates 15,000 square feet. For a water system they have a mill that forces the water into a large tank situated on a high hill, which gives a heavy pressure sufficient for fire protection. The water is piped from the tank into every house, yard and cellar on the farm ; more than three thousand feet of pipe being used in the construction of this system alone.

The plant is equipped with a modern gas machine which furnishes light for the residence and all houses, as well as heating the incubators and brooders. It is very economical and saves a vast amount of labor and greatly reduces the danger from fire as well.

Their brooder house is 225 feet long, 16 feet wide and has a capacity for brooding about 4,000 ducklings under four weeks old.

The middle section of 25 feet is used for feed room and contains feed cutters, steam feed cookers, storage bins, etc. While in the basement underneath is located the gas machine and a hot water heating boiler, which heats the entire building when needed.

The interior of the brooder house is divided into pens 5 feet wide, with a common box brooder running the full length, with a walk back of it. The brooders are heated by 15- and 20-foot sectional coils of hot-water pipes, so that each three or four brooders are run independent of the others. Two gas jets furnish heat through a small copper boiler for each coil.

Each brooder has an outside yard 5 x 100 feet,

made of 12-inch boards. The full length of these yards, however, is not used at all times. The inside pens and brooders are bedded with sawdust or cut straw. Here the young birds are kept until large enough to thrive without a brooder, after which are divided into flocks of about 50 or 75 and placed in cold houses or sheds, with outside runs about 20 x 100 feet.

The main breeding house is 130 feet long by 30 feet wide, divided into 25 pens 10 x 12 feet. Thirteen pens on one side and twelve on the other, with a passage-way between the full length. The balance of the house is used for mixing room. Each pen is provided with an outside run of 10 x 100 feet. This house is capable of housing over 600 breeding ducks very nicely.

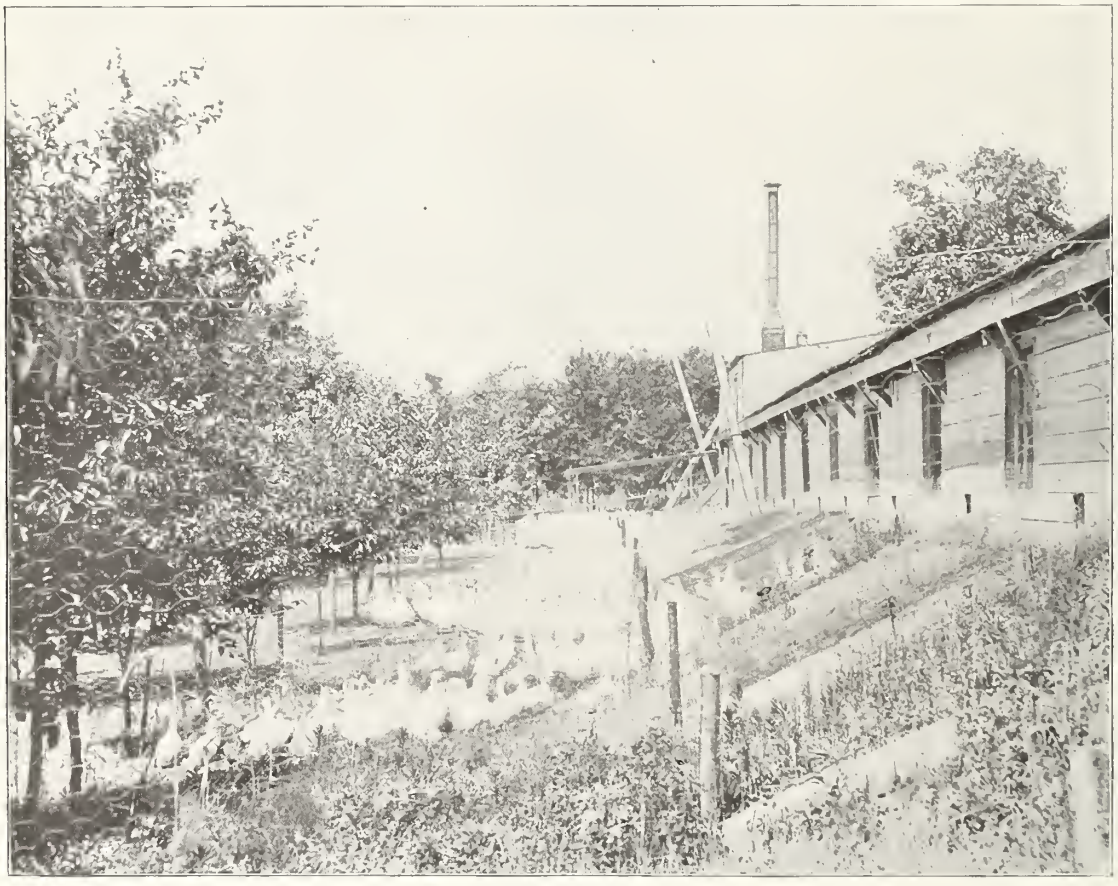
The incubator house is 18 x 52 and contains 3,000-egg capacity of Cyphers Incubators which are all heated by gas. This building is built partially under ground with heavy brick walls which prevents any sudden thermal changes within. Besides the above-mentioned building, there is an office, tool house, ice house, barns, granary, root cellars and several cold duck houses and sheds. In fact, everything that is needed for equipping a strictly first-class duck farm.

Everything is built and arranged with a view to perfect sanitary arrangements and labor-saving devices.

WATER AND FREE RANGE UNNECESSARY.

The Mammoth Imperial Pekin Ducks do not need or care for water to bathe in. They lay fully as many eggs and just as fertile when denied this privilege, while the young do infinitely better without it.

Their ducks have been bred for years in dry yards with simply water to drink and all desire for it for any other purpose seems to be bred out of them. Their ducks thrive and produce fertile eggs, and as many of them when confined in yards as they do when given their liberty.



SEELY & SONS.

METHOD OF HANDLING BREEDING DUCKS.

During the month of July, after their ducks are through laying and begin to moult they turn them out to pasture, where they can procure all of the grass they want. This pasture, if not supplied with natural shade, an artificial one should be arranged for them. This is very important, as nothing so quickly debilitates ducks, both young and old, as extreme hot weather. A simple frame two feet high, covered with cheap boards, will answer.

They now feed them twice a day on about two-thirds wheat bran and one-third corn meal or ground oats, with 5 per cent. of grit. They keep them fed a trifle short in order to force them to forage as much as possible, as it is better for them.

They always use great care that they are supplied with all the water they wish to drink at all times. Young ducks that they wish to reserve for breeding are given the same care after ten or twelve weeks old. About November 15th, according to the season, they change their methods entirely.

The yards adjoining the breeding houses have already been sown with rye, which is now a heavy mat of green. They do this for a twofold purpose, first, to purify the ground, and secondly, to supply the ducks with green feed during the fall and early winter.

They now sort them out and place about twenty in each house pen, using one drake to five or six ducks. They are now fed morning and evening all they will clean up of equal parts of wheat bran and corn meal, to which is added 20 per cent. ground oat feed, 10 per cent. beef scraps, and 5 per cent. of grit. At least 25 per cent. of this feed should also consist of either boiled turnips, beets, potatoes or cut clover. At noon, after the rye in outside yards is exhausted, they give them all of the refuse cabbage or green stuff of some kind that they will eat. Grit and oyster shell should be kept by them continually.

Great care is taken in watering them, as a duck has the faculty of spreading a limited amount of water over an unlimited space in a very short time.

After the weather gets severe they bed their pens with straw.

SEELY & SONS.

With this treatment the ducks usually begin laying in about four weeks, and by the first part of January all should be laying quite regularly.

The first eggs are seldom very strong in fertility, but they soon come up to a high standard in a remarkably short time.

As the season advances they gradually increase the corn meal and animal food.

When they are fed at night they are shut in the house and confined until 8 or 9 o'clock in the morning. By that time they have all layed and are given the liberty of their yards.

They move among the breeders very carefully and always avoid going near them after dark, as continual agitation is not conducive to egg production.

SEELY & SONS.

METHOD OF CARING FOR DUCKLINGS.

After the ducklings are hatched we let them remain in the incubator for twenty-four hours, or until the twenty-ninth day. They are then removed and placed in brooders, about 100 in each, after which they are fed and watered for the first time.

The first few days we guard them very closely and do not allow them to get chilled or wet, and after feeding we see that all get back into the brooder. After a day or two they get accustomed to their surroundings and give no more trouble in this respect.

Their feed for the first week consists of equal parts of cracker or bread crumbs and rolled oats, 5 per cent. hard-boiled eggs, 5 per cent. grit and the whole slightly moistened with sweet milk.

They are fed this mixture every two hours, just what they will eat and no more.

The next five weeks they are fed four times daily on equal parts of wheat bran, corn meal and ground oat feed, 5 per cent. beef meal, 5 per cent. grit and some green stuff, such as cut rye, chopped cabbage, etc.

The seventh and eighth weeks we feed three times daily equal parts corn meal and wheat bran, 10 per cent. beef scraps, 5 per cent. grit and plenty of green stuff.

From this time on until ten weeks old we feed three times daily, two-thirds corn meal and one third wheat bran, 10 per cent. beef scraps, 5 per cent. grit and very little green stuff.

At this age they should weigh five to six pounds each and are ready for market.

For newly-hatched ducklings they keep the brooder heat at about 95°, and gradually reduce it as they grow. During the spring months Messrs. Seely & Sons seldom give their ducklings a heated brooder after they are two or three weeks old, and during the summer one week to ten days is sufficient.

Messrs. Seely & Sons have used many different makes of incubators, but none have given them the general satisfaction that does the Cyphers. They show a large and growing plant, and stand at the head of the Western duck breeders, and we are very glad to class them among our customers. We have great faith in the Middle West as a poultry-producing section, and believe that the Western breeders will outnumber the Eastern at no distant day.

SEELY & SONS.

THREE REPORTS FROM FISHER'S ISLAND FARM.

FISHER'S ISLAND FARM INCUBATOR RECORD, SEASON OF '97 AND '98.

SET.	INCUBATOR.	KIND OF EGGS.	TOTAL NUMBER.	FIRST TEST.	SECOND TEST.	TOTAL FERTILE.	HATCHED.	REMARKS.
March 8.	Cyphers	Hens'	340	85	5	250	222	The machine did not vary over 1¼ for the 21 days.

TEMPERATURE.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL.
Morning	103	102	102	102	102	103	103	103	103	101½	102	101½	102	102	102	102	102	103	103	102	103											
Noon . .	102	102	102	102	102	102	102	102	102	102	103	103	103	103	102	102	102	102	102	102	103											
Night . .	102	101½	102	102	102	102	102	102	103	103	103	102	102½	102	102	102	102	102	102	102	102											

FISHER'S ISLAND FARM INCUBATOR RECORD, SEASON OF '97 AND '98.

SET.	INCUBATOR.	KIND OF EGGS.	TOTAL NUMBER.	FIRST TEST.	SECOND TEST.	TOTAL FERTILE.	HATCHED.	REMARKS.
April 27.	Cyphers.	Hens'.	350	41	22	287	251	The best chicks of the season.

TEMPERATURE.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL.
Morning	100	103	103	102	103	102	102	102	102	102	102	102	101	102	101	102	103	103	102	103	103											
Noon . .	100	103	103	101	103	102	102	102	102	102	102	101	102	102	102	102	103	102	103	102	103											
Night . .	103	103	102	102	103	102	102	102	102	102	102	101	102	102	102	102	102	102	103	103	102											

FISHER'S ISLAND FARM INCUBATOR RECORD, SEASON OF '97 AND '98.

SET.	INCUBATOR.	KIND OF EGGS.	TOTAL NUMBER.	FIRST TEST.	SECOND TEST.	TOTAL FERTILE.	HATCHED.	REMARKS.
May 23	Cyphers.	Hens'.	340	42	11	287	253	

TEMPERATURE.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL.
Morning	102	102	103	103	101½	102	102	103	102	101½	102	102	101	103	102	102	103	103	102	102	103											
Noon . .	100	102	102	102	102	102	102	102	102	102	102	102	102	102	102	103	103	103	101	103	103											
Night . .	102	102	102	102	102	102	102	102	102	103	102	102	102	101	102	103	103	103	103	103	103											

Mr. J. F. Crangle, manager of the Fisher's Island Poultry Farm, at Fisher's Island, N. Y., has demonstrated what can be accomplished in the poultry business by a live, hustling man. As the result of his labors, Fisher's Island Farm is now one of the great poultry plants of the country, and is a successful, money-making institution.

The poultry division of the farm comprises about sixty acres, all inclosed by a fence of wire netting. Outside this are miles of moorland, with a broken surface of well-drained gravelly or sandy soil and abundantly supplied with cover. The buildings on the plant embody the most modern ideas obtainable, and are constructed for business. The incubator house is built entirely above ground, and is 24 x 40 feet, triple boarded, with double air spaces. It is ceiled inside with matched pine, and has double windows with shades. Regarding incubators, Mr. Crangle says he wants not only a machine that will hatch chicks, but one that will hatch chicks that can

be raised. For this and other reasons equally potent, Mr. Crangle likes the Cyphers and uses it in his cellar.

The temperatures of the incubators are taken and recorded three times daily. On each incubator is a record blank, which is reproduced herewith, giving a complete history of each hatch:

Mr. Crangle attends to his incubators personally, because he believes that many germs are killed by careless handling, and he attaches little importance to the particular position in which each egg lies.

In brooder houses the farm has applied the system advised by the Cyphers Incubator Company, that is, using indoor brooders for the first ten days or so after the chicks come out, and then letting them run in the regular runs of the brooder house. Their brooder house is 320 feet long by 20 feet wide, with a 4-foot alley-way running its entire length. The house has a cement floor, is ceiled inside the studding and beneath the collar beams, with matched Georgia pine, making it double-walled throughout. Twelve ventilators are distributed at regular intervals along the apex of the double pitched roof, and trap doors open through the ceiling over the walk. Opening these trap doors to the open space between the ceiling and the roof gives a gentle draught, thus ventilating the building nicely.

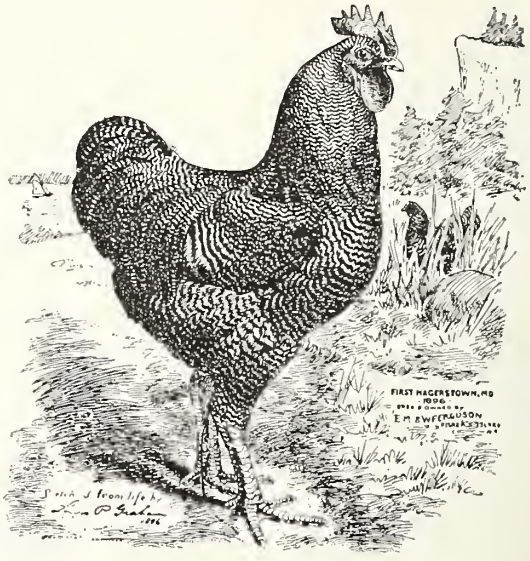
The pens in the first section of the brooder house are 10 x 16 feet, and each is occupied by an indoor brooder. A hot-water heater is set in a pit in the center of the house, with a set of flow and return pipes within the usual hovers in the west end only, a bank of pipes extending along the wall at the back of the walk in both sections of the house. Here is a brooder house with *ample* heating capacity for any weather; no matter how low the temperature ranges, Mr. Crangle said, he "could turn in at bed time perfectly satisfied that the temperature in that brooder house wouldn't drop 2° through the night." This is in marked contrast with many brooder houses, where, to save a dollar or two, the owner had put in a too small heater, or too small pipes, and when the zero nights came found he couldn't keep up his temperature. It pays well, sometimes, to expend that additional dollar or two; it is false economy to be too saving.

Mr. Crangle uses the double system of brooding, for the good and sufficient reason that it gives him the best results. He puts his chickens and ducklings into indoor brooders for the first week or ten days, then moves them on to the hover pens in the other half of the brooder house, and that system of handling chicks gives him better results with fewer losses than brooding them throughout in the indoor brooders or putting them at once into pens and hovers.

Asked how many youngsters he had out, Mr. Crangle replied, "About 4,000—of all kinds," but that "all kinds" covers a wide range of land and water fowl. Barred, White and Buff Plymouth Rocks, White Wyandottes, Indian Games, Bronze turkeys, Pekin, Wild Mallard and Wild Black ducks, African and wild geese, pigeons, pheasants, quail and Belgian hares make quite a list; and when one considers the individual peculiarities of those various breeds and species he will realize that it *is* a wide range, and that to breed and handle all of them successfully means an immense amount of study and observation on the part of Mr. Crangle.

There is, besides the brooding house, a long breeding house for laying stock, 150 x 20 feet, divided into a 4-foot wide walk and pens 12 x 16. This house also has a concrete floor, and is ceiled with matched stuff. Yards 98 feet long extend south from the pens in this house. Choice clover hay is used as scratching material for the hens. It is left in the pens for from ten days to two weeks and then taken out and used for bedding for the breeding ducks.

A Fisher's Island Farm Winner.



Munnatawket The First.

Considerable breeding stock is put out in colony plan houses, each having a scratching shed attached.

A little further along is the pheasantry, where the breeding pheasants are closely confined during the breeding season. In a three or four acre grass field outside are a score of families of pheasant chicks. Near the center of the sixty acre poultry track is the aviary, where are some 450 pigeons kept for squab breeding. A little further along, near the edge of a fresh water pond of perhaps half a dozen acres, are pens of wild water fowl, and a wonderfully fine family of African geese. A pair of pure wild geese, with their family of four young, had a yard by themselves and were an interesting study. Mr. Crangle said they were "lassoed" on the pond.

He said wild geese eggs were almost invariably all fertile, and all hatched. He raises about 300 wild ducks, Blacks and Mallards, which are sold to game clubs for decoys. Of course they fetch good prices because of the great difficulty of hatching and raising them in confinement. Wild Mallards will lay fifty to sixty eggs apiece, but wild Blacks lay usually but one litter of twelve eggs. These wild fowl all sit on their own eggs, and mother their young. The method of keeping them in confinement is clipping off the first joint of one wing as soon as hatched.

FISHER'S ISLAND FARM.

The turkey department is a most interesting study. There were not many turkeys, old or young, visible to the eye, almost all the hen turkeys being engaged in sitting, in nests hid away in the tangled bush, or else mothering their poults away down on the pastures to the eastward four or five miles away. Mr. Crangle has had paths cut through the bushes where the nests are likely to be, and when a nest is located a small painted stake is set near to mark the spot. The eggs are collected every day till the hen wants to sit, then she is given a clutch of fifteen to eighteen eggs. The young turkeys are quite tender at first, and have to be fed and cared for regularly, but when they are a month old, or thereabouts, the family is moved away off to the wild and pasture land at the east end. A man visits these families two or three times a week, to see that they are all right and give them each a handful of grain—half the time they don't eat it—as much to keep them from becoming irreclaimably wild as anything, and they grow and thrive there, feeding on berries, grasshoppers, etc., till it is time to gather them up, in October. The gathering up is by "turkey drives," by three or four men on horseback, gathering some seventy-five to 100 together and driving them to a "house trap" on one of the east farms.

Mr. Crangle's feeding formula is as follows:

The chicks are fed first with oatmeal and bran. The bran is wet up and the oatmeal stirred in sufficient to make it so dry that it will not stick to the fingers. A few days later, cornmeal is added, and cracked corn later forms a part of the daily ration. When feathering begins, a very little meat is added, but great caution is necessary with this, as too much is liable to upset the chicks. If milk is fed, meat is not needed. Charcoal and grit are furnished. The floors of the brooder house are deeply covered with clean sand. Pure water is given. Stale bread is sometimes fed. Thus handled, with plenty of range, they are almost sure to grow into strong, vigorous fowls.

The Fisher's Island Farm has had a big trade in eggs the past season. The live stock is nearly all marketed right on the Island, which has a summer population of nearly 2,000 people, and high prices are obtained for broilers, ducks and other similar stock.

The Fisher's Island Farm Exhibits at the great Eastern poultry shows attract more attention than those from any other farm.

AGRICULTURAL DEPARTMENT.

A. A. BRIGHAM, PH.D.,
Professor of Agriculture.

HOWLAND BURDICK, B SC.,
Farm Superintendent.

M. H. ARNOLD,
Poultryman.

RHODE ISLAND COLLEGE OF
AGRICULTURE AND MECHANIC ARTS.

J. H. WASHBURN, Ph.D., President.

KINGSTON, R. I. Sept. 10, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Dear Sirs:

In reply to your favor of September 6th, I am happy to state that we have tested the Cyphers Incubator very thoroughly for two seasons in the incubator house connected with the poultry plant of the Rhode Island College of Agriculture and Mechanic Arts, and find it most satisfactory in construction, in materials and in price, in ease, economy and regularity of running, and in percentage of hatches. Especially deserving of commendation, is the simple and effective plan of heating and ventilation, which secures a uniform temperature for all the eggs in the egg chamber, and regulates to a nicety the evaporation of the moisture of the eggs.

Wishing you the best of success, I remain,

Yours very truly,

A. A. BRIGHAM.

KINGSTON, R. I., EXPERIMENT STATION.

Of the agricultural institutions in this country productive of the most good in poultry research, the Rhode Island Experiment Station at Kingston, R. I., stands at the head. Prof. A. A. Brigham, soon after taking hold of the institution several years ago, saw the advantage of establishing a course of study and experiment in poultry raising, with the result that a poultry plant for educational purposes was erected. Today this plant has assumed proportions far exceeding the fondest anticipations of its projector, and numbers of young men are turned out from there thoroughly equipped for taking charge of any modern poultry plant.

The college has a good force of instructors in the sciences and arts upon which poultry culture is based. Several expert poultry specialists will assist the instructors in the course this season, as was done last year, when such well-known men as Mr. George H. Pollard, Mr. F. L. Sewell, Mr. I. K. Felch, Mr. Charles A. Cyphers and others addressed the students on practical topics devoid of any advertising features.

The special short course of study this year will include instruction in the following topics: Poultry plants, location, planning and establishment, drainage of the land; buildings, planning and drawing of plans, making specifications and estimates, location and arrangement, construction, ventilation and furnishing; fowls, their origin, kinds and breeds, principles of breeding, mating, special breeding of water fowl, turkeys, pigeons, etc.; incubation and rearing both natural and artificial; foods, feeding, care and management, production of eggs and flesh, caponizing, fattening, killing, dressing and marketing, diseases, business methods and management, scoring, records, accounts, etc.

Instruction is given in zoology, anatomy and physiology sufficient for a foundation for the course. Embryology is taught in the biological laboratory where also the nature and habits of poultry parasites will be studied. Carpentering and the construction of poultry houses and fences is also taught by practice in the carpenter shop and poultry department. A special study is made of the chemistry of poultry foods and the balancing of rations.

Mr. M. H. Arnold, Manager of the Poultry Plants of the College Farm and Agricultural Experiment Station, will aid and guide the pupils in their practice in running of the incubators and

brooders and in the feeding, care and management of the fowls.

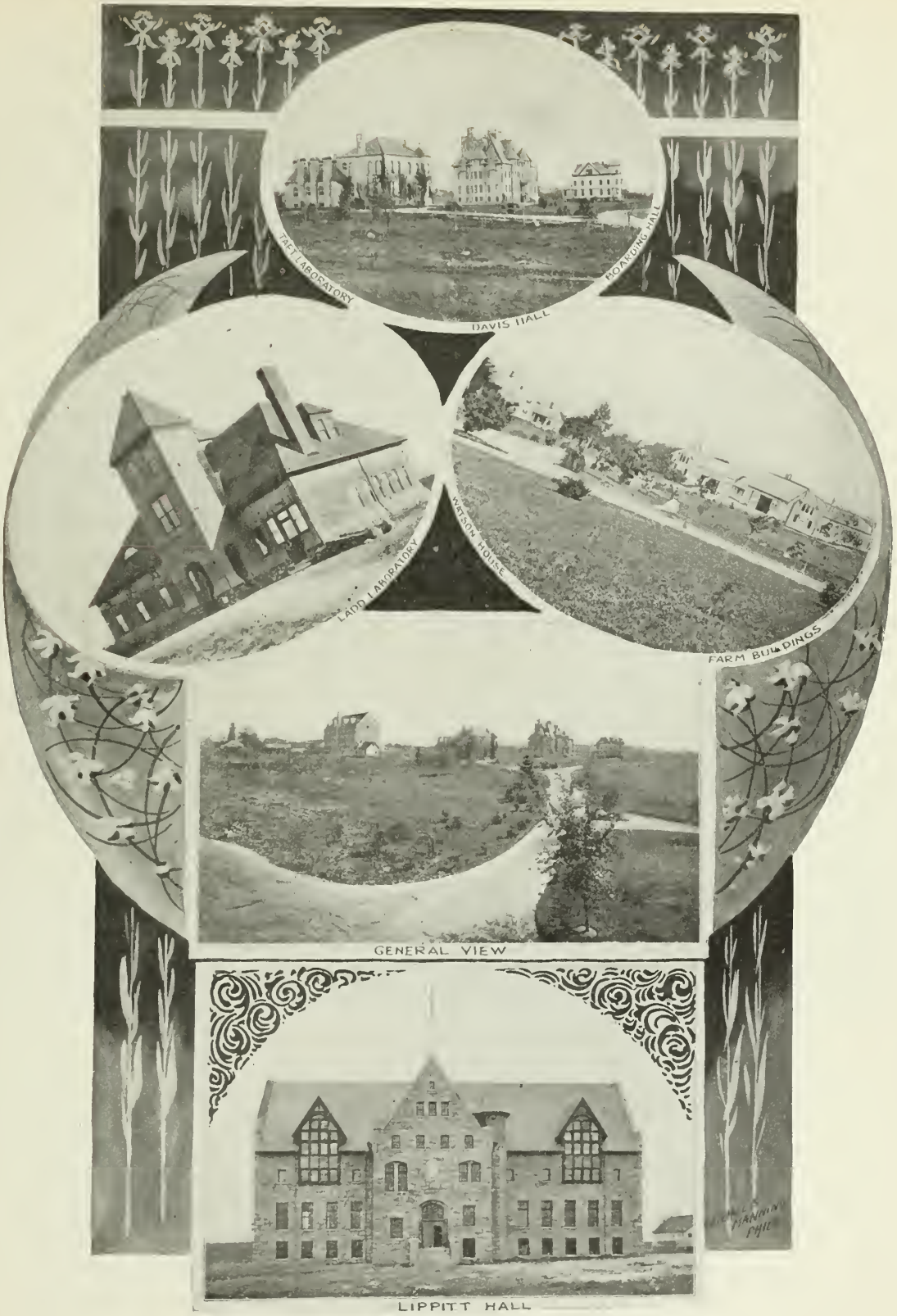
During the course the forenoons are devoted largely to lectures and class-room work; the afternoons to laboratory work and to practice in the carpenter shop, incubator-house and brooder-house, and in the management, care and feeding of the fowls; the evenings to study, to meetings for discussion, etc. Saturdays are devoted chiefly to inspection excursions of the class to different poultry farms in New England. Special public lectures are also occasionally given. Opportunity is further offered to a limited number of students to supplement this special course of study by a year's practical training in the work of the College Poultry Plant.

The necessary expenses of the course to the pupils are very moderate. The only tuition fees are in connection with the use of the carpenter shop, laboratories and incubator and brooder-houses. For the course in each of these $1 is charged each pupil. A few dollars are required for the purchase of reference books, note books and class room supplies, all of which are furnished at cost by the College Book Store. Board at the College Dining Hall is $3 per week. Lodging during the four weeks of the course can be arranged for in several of the college buildings or in the village of Kingston and the neighborhood at from 50 cents to $1.50 per week. A special fee of $5 will be charged pupils from outside the State of Rhode Island. Twenty-five to $30 should cover the necessary expenses of a student while on the grounds. No entrance examination is required. Oral or written examinations will be given during and at the close of the course and certificates will be awarded according to merit. The College is co-educational. The class will be limited in number to twenty students.

This in brief covers the course of the school year, and will be found to be very comprehensive.

POULTRY CLASS OF '98, KINGSTON EXPERIMENT STATION.

The poultry plant has been moved down into the valley, nearly half a mile from the college buildings, and is, in fact, a consolidation of two poultry plants, the buildings belonging to the college having been moved down to the new location and added to the buildings already there, the experiment station having taken a lease of land and buildings formerly used by a poultry raiser. Here, spread out over several acres, is a large assortment of poultry buildings of many different designs and patterns, some with scratching sheds and some without, also many colony (or detached) houses, a long hot-water pipe brooder house, an incubator cellar, etc. A tiny little



KINGSTON EXPERIMENT STATION.

brook, fed by springs on the hillside above, makes a splendid location for geese, ducks, etc., and considerable work is being done with those varieties of water fowl; but the poultry and eggs department was of greatest interest to us.

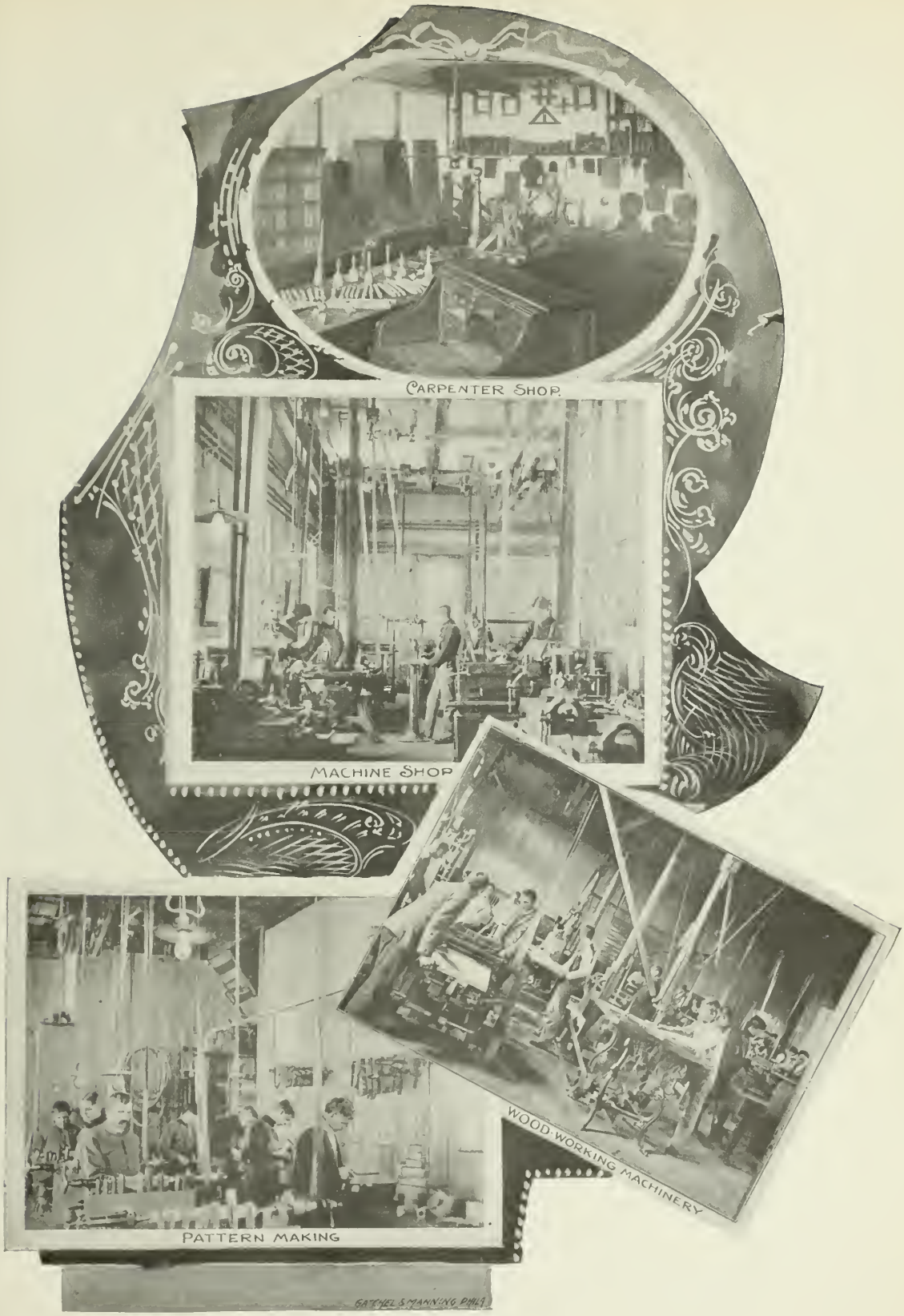
The incubator cellar is built into a slightly sloping bank, the earth being thrown out each side, and the walls are made of pounded clay, the only real construction being the roof and front end. The cellar is sealed above the collar beams to make a dead air space of the roof space, the better to keep an even temperature, and a trap door opening up into that air space serves for ventilation through an air shaft above. The Cyphers Incubators are operated there, and pupils have an admirable opportunity to study incubator operations.

Professor Brigham has been experimenting on the brooder house question, with a system of warming the air and passing it on to the hovers of two or three of the pens, the pipes themselves not being in the hovers or near the chicks, and he thinks the ideal method of brooder construction would be practically similar to that used in heating and ventilating larger buildings —that is, of having a hot-air chamber to which the cold air is admitted from outside, to be heated by passing over and about steam- or hot-water pipes, then forced by a blower or drawn by an exhaust into the hovers. Professor Brigham gave it as his opinion that the principle of diffusion of warmed air, similar to the principle employed in the Cyphers Incubator, would be most excellent.

Professor Brigham has many different varieties in his poultry houses, and the pupils there will have a fine opportunity to learn of the individual characteristics and advantages and disadvantages of each. The Rhode Island Reds come in for a considerable interest there, Professor Brigham believing them worthy of a prominent place, both because of their great merits as practical fowls, and also because of their being a distinctively Rhode Island variety.

The cocks of the Rhode Island Reds weigh from 8½ to 9 pounds, and are very erect and lively; the hens weigh 6½ to 7 pounds, and are very energetic and excellent winter layers of large brown eggs. They make prime poultry, dressing off smooth and yellow. The chicks are plump,

INCUBATOR CELLAR, KINGSTON EXPERIMENT STATION.



KINGSTON EXPERIMENT STATION.

can be dressed for market at almost any age, and the pullets begin laying at five months, or even earlier if forced. Professor Brigham is justly proud of the breed, and is taking great pains with them.

The benefits to be derived from the work at the Experiment Station can be no more forcefully illustrated than by quoting the words of a writer in the *American Fancier*, who said:

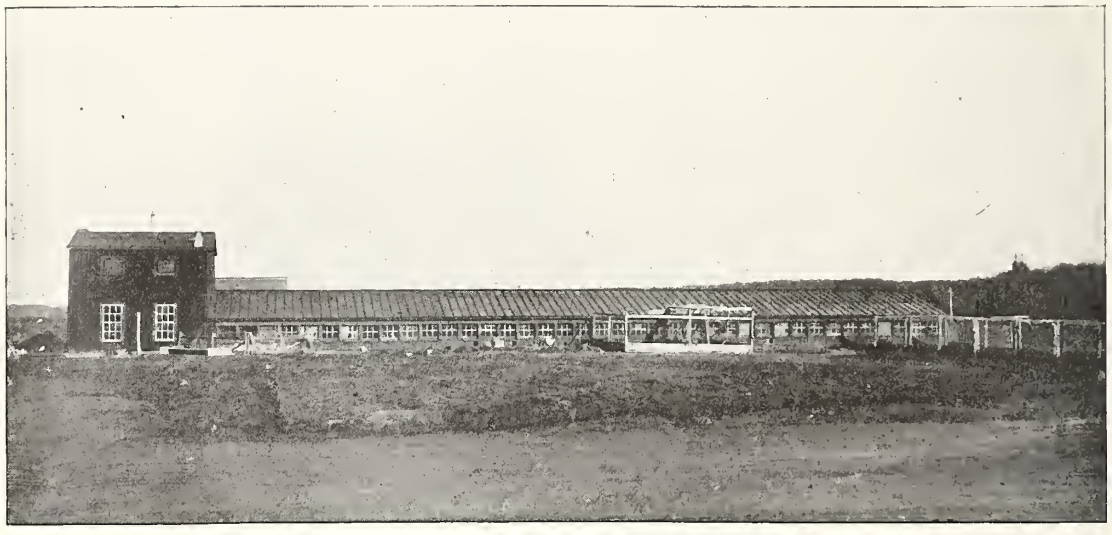
"I am sixty-four years old, and have thought I was able to teach in the art of poultry culture, but I say to you that the forty minutes which I spent in the lecture room where embryology was being taught were worth to me a snug sum of money just for the train of thought that was awakened in me, and for the clearing up of several points in chicken incubation that I thought I had already understood. These young students start with clear ideas, which will make personal experience tell for success. If I am any judge of human nature a larger percentage of that class will be successful in the poultry business than are the average in other callings. These students were not afraid to ask questions. They were ready to give up the moments between lectures to continue the discussions.

'My best wishes go with the class. May their success be in keeping with their advantages, is the earnest desire of I. K. Felch."

Professor Brigham is always open to suggestions and will appreciate such as is evidenced by the following circular which he is now sending out:

To Poultrymen and Farmers:

The poultry plants of the Experiment Station and College Farm having been placed under my control, the work of experimentation and instruction will be carried on conjointly. Concerning the most desirable lines of investigation and experimentation to be undertaken, I desire the freest and fullest expression of opinion by poultry men and all persons interested in poultry culture. We are considering plans of experimentation relative to poultry foods and feeding, the heating and ventilating of artificial brooders, breeds and breeding, prevention and treatment of diseases, methods of management, utilization of by-products, etc. We shall welcome such suggestions, especially, as result from your own practical experience and study of these or other questions in poultry keeping. Your problems are our problems and we offer our co-operation to the fullest extent possible in the solution of the perplexities of the poultry business.



BROODER HOUSE, KINGSTON EXPERIMENT STATION.

To lay the foundation for systematic study and work, we offer a four weeks' special course of instruction in poultry culture, to be given the coming winter, commencing early in January, 1899.

A circular of information will be sent on application to all who desire to know more of this opportunity.

Address,

A. A. Brigham,

Agriculturist.

Kingston, R. I.

HUNSBERGER POULTRY FARM

PEKIN DUCKS A SPECIALTY

EGGS AND BREEDERS IN SEASON

South Hatfield Pa., Oct. 24, *1898.*

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

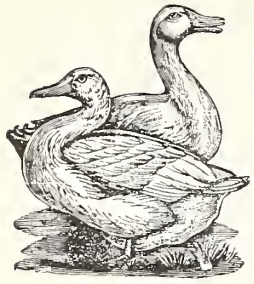
After using some of the leading makes of incubators, we discard all but the Cyphers, finding that, as it follows Nature's method as nearly as possible, it is the most successful hatcher.

We have had grand success hatching duck eggs with the ten 360 egg Cyphers purchased last season.

Yours very truly,

HUNSBERGER BROTHERS.

= HUDSON RIVER POULTRY FARM =



EDGAR BRIGGS, Manager

Breeders of

White and Buff Wyandottes, Barred and Buff Plymouth Rocks and Pekin Ducks

EXHIBITION STOCK SPECIAL MATINGS FOR 1899

Poughkeepsie, N. Y., Oct. 11, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

We have run ten of your 360 egg incubators during the past season, principally on duck eggs, with very good results, getting out near 1,500 ducklings more than ever before, with about the same number of breeders. For a fine running machine, easy and quick to handle, the Cyphers has no equal, the temperature is always right. We will put in more the coming season.

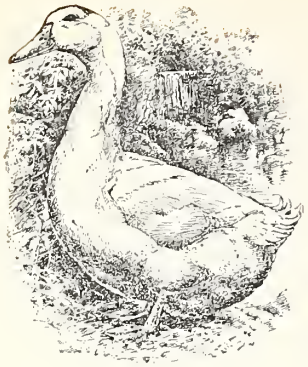
I made a hatch of 83 per cent. in the summer, and put about 127 chicks in your outdoor brooder, and raised nearly every one, and a finer lot of chicks I never saw.

Having visited and carefully inspected your factory, where I saw every part of the machine in process of construction, I can safely say no better machine has ever been placed on the market.

Very truly yours,

EDGAR BRIGGS.

HUDSON RIVER POULTRY FARM



D. H. MENOUGH J. D. BURN R. A. WALKER

Oxford Poultry Farm

Pekin Ducks a Specialty.

Eggs and Stock in Season.

W. H. JONES, Superintendent.

Oxford, Pa., Oct. 9, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

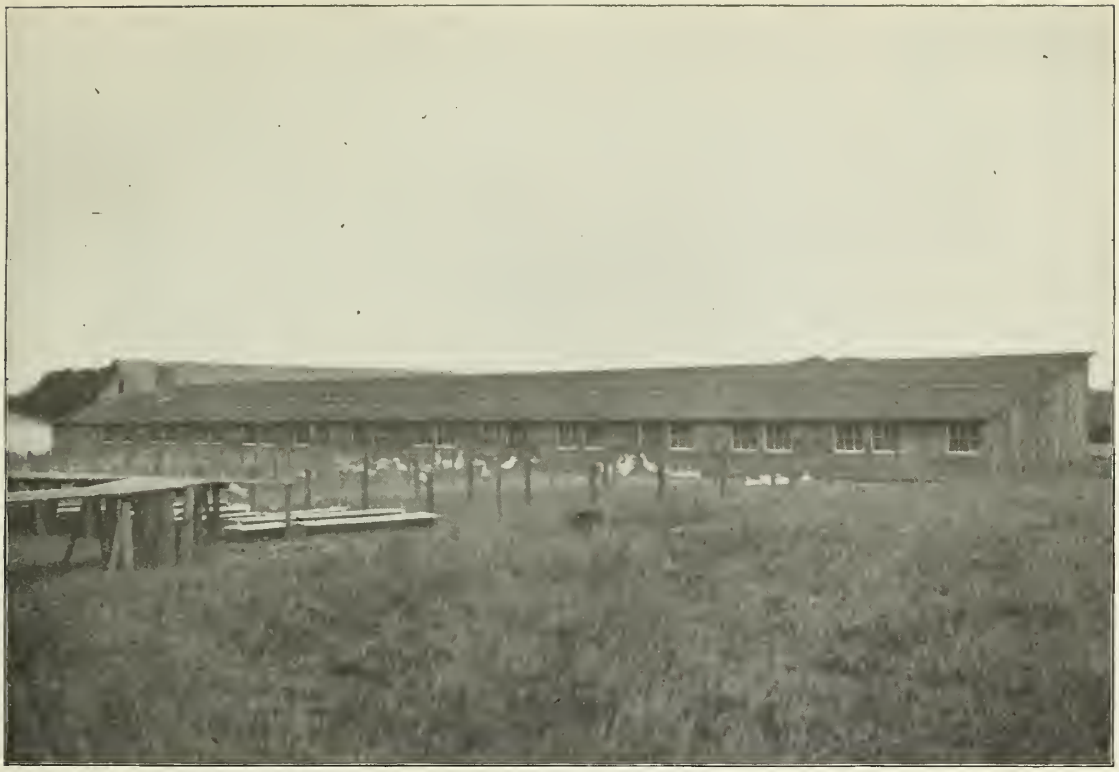
Gentlemen:

We have 10 of your No. 3 machines and expect to put in 6 more this coming season. I can say I have used 21 different makes of incubators, commencing with Perfect Hatcher and Halstead, manufactured away back in the seventies, down to present makes; but. for paying results and least attention, the Cyphers leads them all.

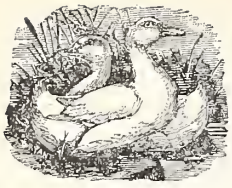
Your new lamp on this season's model is an improvement. I have hatched as high as every fertile egg, and with two of your 360 egg machines I hatched 518 chicks out of a possible 537.

Yours truly,

WILLIAM H. JONES.



OXFORD POULTRY FARM.



JOSEPH WALKER

Breeder of PEKIN DUCKS

Westboro, Mass. Oct. 11, *1898.*

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

I have nothing but praise to give your machines. The chicks and ducklings are stronger and better at one day, than from my other machines at a week, and the ducklings hatched in the Cyphers are better at 8½ weeks than those from my other machines at 10 and 11 weeks. Moreover from the Cyphers I can get an average of from 15 to 25 per cent. more ducklings from the same number and quality of eggs than from my other incubators, into which I shall never put another egg, but will turn them into brooders.

Where one of your machines was placed, the temperature of the room varied as much as 25 degrees between night and day, and I got good hatches under these conditions too, so how can I but speak a good word for the Cyphers.

Yours truly,

JOSEPH WALKER.

HOW TO SHIP STOCK.

Through the courtesy of Mr. Hugo Josephy, of No. 180 Chambers Street, New York, one of the leading commission merchants of the East, we are enabled to offer the following suggestions on preparing stock for market:

Much risk of loss in shipping goods to market may be avoided by giving particular attention to having them arrive in good condition and with a handsome appearance.

MARKING AND SHIPPING.

Mark plainly and *neatly* on the head or cover of every package its contents, gross weight and pair, or the number of dozens, pairs or pieces contained. Also the name, initials, or shipping mark of the shipper, and the address of the firm to which the package is sent. Stencil-plates for this purpose will be furnished on application. Where large lines of goods are shipped, simpler marks may be used by arrangement between the parties. Always get receipts from the express or transportation companies, and send immediately full advices, with correct invoice of shipment, by mail. When poultry and game are forwarded by express, put a letter of advice in one of the packages, and mark plainly on the outside "Bill," advising by mail also. Nothing is so vexatious to a commission house as the receipt of consignments not properly marked and advised. Every shipper who designs to make a business of forwarding good articles should have a brand or mark of his own. Thus he may establish a reputation for his goods. Perishable articles should be shipped so as to arrive in New York not later than Friday morning.

PACKAGES.

Use only very *neat* packages, as light as is consistent with carrying the contents perfectly. In a lot of goods, have all the packages of uniform size, shape and style. In shipping articles that require air, be sure to allow for ventilation. When articles are sold by the package, use only those of standard size.

The great end to aim at is to have the poultry reach market in perfect order, firm, bright and sound, and that it may present as handsome an appearance as possible. Shippers who are able to get their goods to market in uniformly fine order, and whose study of all the details of killing, dressing and packing result in uniformly fine quality, soon acquire a reputation for their goods among buyers, which is of great value to them.

Have the crops of chickens and turkeys empty when killed. It is best to keep food from them for twelve to twenty-four hours before killing. Ordinances in force in nearly all large cities make this imperative. In case any fowl should be found to have food in its crop after killing, it should be removed by making a clean-cut incision in the back of the neck and the full crop worked out under the skin. Never try to force the food out through the mouth, as this is liable to cause discoloration.

There are two methods of dressing—dry picking and scalding. As a general rule chickens, fowls and turkeys which command the highest prices are dry picked, but by no means do all dry picked lots sell higher than scalded. Lean poultry always look much thinner when dry picked than when scalded and plumped, and thin poultry command more when scalded than when dry picked. For this reason chickens and turkeys should be picked dry only when very fat and of fine quality. Ducks and geese should always be scalded.

The method of packing poultry for shipment depends upon the weather and the purpose of the shipper. Stock intended for the freezer, to hold for future use, is always packed dry. That intended for immediate shipment and use may be packed dry or in ice, but should be packed dry only after settled cold weather.

SELECTION OF STOCK FOR MARKET.

No poultry should be killed for market which is not of reasonably good size and in good condition. Small, thin, framy turkeys, such as are often received here very early in the season, are always a drug on the market aud are unprofitable. None should be dressed, even in September, which weigh less than 7 pounds each, and later 8 pounds should be the bottom limit. Spring chickens should never be killed before they attain a weight of at least 1 pound each, and this size is profitably salable only very early in the season. As soon as supplies become at all liberal, 1½ pounds each should be the bottom limit of weight. Spring ducks should be kept back until almost full grown. We receive full grown spring ducks from Long Island and the East very early in the season, and these bring high prices. Western packers, seeing the high quotations for these, often send in a lot of very small young ducks, about the weight of broiling chickens.

J. F. STOCKING & CO.
Mammoth Pekin Ducks,
WHITE WYANDOTTES.

C. H. STOCKING.
J. F. STOCKING.
K. A. STOCKING.

MONTVALE, N. J., Aug. 2, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

Replying to your communication of the 29th ult., would say that we have no reason to change our opinion expressed last season. We believe that the Cyphers is the best incubator on the market.

As long as our duck eggs were fertile, our hatches were phenomenal. Fertility was unaccountably poor this season, and as early as March showed up exceedingly weak, continuing so for the balance of the season. Still, out of 12,223 eggs set, we secured 6,242 ducklings, or a little better than 51 per cent., running the machines as you know, in the cold side of the double brooder house.

Very truly yours,

J. F. STOCKING & CO.

Such are unsalable at any reasonable price. Spring ducks are never used to broil—always to roast—and there is no call whatever for stock weighing less than 3 and 4 pounds each.

METHOD OF KILLING.

One of the most essential points in dressing poultry so as to carry well is to get all of the blood out of the body which can possibly be withdrawn. The manner of killing affects the flow of blood materially. All kinds should be killed by cutting through the roof of the mouth to the brain with a sharp-pointed knife. But if the fowl is "stuck" very hard and deep, so as to cause instant death, the blood will not flow freely and the feathers will be set so as to be difficult of removal, especially if dry picked. Proper killing is an art that requires practice and judgment.

DRY PICKING.

Immediately after killing, carefully and very cleanly remove the feathers, taking especial pains to avoid tearing the skin. When dry picked poultry is to be packed dry for cold weather shipment it should be hung up head down in a cold place (but not cold enough to freeze), and left until thoroughly cold and dry. Any animal heat left in the body when packed, and any moisture on the skin, is sure to cause bad condition in a short time.

When the dry picked poultry is to be packed in ice for warm weather shipment, it should be thrown into water of natural temperature, and left there for fifteen or twenty minutes, then removed to ice water, where it should remain eight to ten hours, when it will be ready to pack.

STOCKING'S FARM.

Just the right thrust of the knife will reach the brain and paralyze the fowl, will relax the muscles, so the feathers may be afterwards easily removed and permit a free flow of blood before the fowl is actually dead. Free bleeding is so important that too much care cannot be taken in acquiring just the right method of killing.

METHOD OF DRESSING.

Great care should be taken to avoid cutting or bruising the flesh or breaking the bones. "Bumping" with the idea of driving the blood into the spinal column should not be permitted; it often breaks the back and almost always makes a bruise which causes discoloration. Moreover, it is entirely unnecessary if the poultry is handled according to instructions.

SCALDING.

The water for scalding should be just at the boiling point, but not actually boiling. Immerse the birds, holding by legs and head and lifting up and down in the water three or four times. Immediately after scalding chickens and turkeys remove the feathers—pin-feathers and all—very cleanly and without breaking the skin. After scalding ducks and geese, wrap them in a cloth about two minutes; then the down will roll off with the feathers. All scalded poultry should be "plumped" after picking by dipping for about two seconds in very hot water—just under the boiling point—and then thrown into cool water of the natural temperature, where it should remain for fifteen to twenty minutes. When the scalded poultry is to be packed dry for cold

Elm Hill Poultry Farm,
EAST FOXBORO', MASS.
JOS. F ORTIZ, - - PROP'R.

East Foxboro', Mass., Sept. 27th, 1898.

THE CYPHERS INCUBATOR CO.,

WAYLAND, N. Y.

Gentlemen:

In reply would say that your machines give me no trouble to operate. I give them but little attention, as they require but little. The results from them have been entirely satisfactory. They are all right. The workmanship I consider far superior to other makes I have on my plant. Will put in the complement of fifty as fast as I can use them.

I have turned my 600 egg hot-water machines into brooders, to use in connection with my large brooder house, as your hot-air machine suits me best. I find a very even temperature throughout the egg chamber. I also like your system of turning the eggs.

Wishing you every success, I remain,

Yours truly,

JOS. F. ORTIZ.

weather shipment it should be taken from the first cold plumping water and hung up by the feet until thoroughly cold and dry; it will then be ready to pack. But when it is intended to pack in ice for warm weather shipment, the poultry should be transferred from the first cool bath to another of colder water (not ice water) and remain there for one-half hour to one hour, after which it should be placed in ice water and left for eight to ten hours, when it will be ready to pack.

The object of placing the stock, after scalding first in water of moderate temperature is to encourage the flow of blood, which would be checked if the stock were plunged immediately into ice water.

alternate layers of poultry and straw, stowing very snugly, backs up and legs out straight, filling so full that the cover will draw down firmly upon the contents. Some successful shippers use no packing, filling the package solid full of poultry, but using waxed or parchment paper around the sides, bottom and top of case or barrel and between the layers of poultry. If this method is adopted, however, the utmost care should be taken to have every fowl perfectly dry before packing. The use of straw packing is generally preferred and is considered safer, unless goods are destined for storage. All blood remaining about the mouth or head should be removed with a damp cloth.

ELM HILL POULTRY FARM.

Guard against overscalding and underscalding; the former causes the yellow cuticle to loosen and rub off, giving the poultry a bad appearance, and the latter increases the danger of the stock becoming slippery in transit.

PACKING FOR DRY SHIPMENT.

Packages should be neat, clean and strong enough to carry the contents perfectly. Use either barrels or cases holding about 200 pounds; the latter are the best for turkeys and geese. If any packing is used it should be only clean, dry and hand-threshed wheat or rye straw. Place a layer of straw in the bottom of the package, then

PACKING FOR SHIPMENT IN ICE.

For shipment in ice, use only poultry or sugar barrels; if the latter, they should be thoroughly washed with hot water. Place a layer of cracked ice in the bottom and alternate layers of poultry and ice until the package is nearly full. Over the top layer of poultry place a layer of cracked ice, then a piece of burlap, and cover this with a layer of cracked ice; on top of that a large chunk of solid ice, fastening all in place with a piece of burlap secured under the top hoop. Pack the poultry breasts down and backs up, with legs out straight toward the center of the barrel, making a ring of fowls side by side around the staves,

backs sloping inward, so that the next layer of ice will work in between the poultry and the staves. The middle of the layer may be filled in with the fowls at will.

PACKING FOR FREEZER.

Poultry frozen during the winter as a means of preserving it for later use should always be dry picked. Only the very choicest goods should be selected for this purpose, and extraordinary care must be taken that the stock be thoroughly cold and dry when packed. The treatment varies according to circumstances, weather, etc. Probably the best results are obtained when the stock can be frozen by natural out-door temperature. But in seasons and localities where this is impossible the freezer may be used successfully. Cases only should be used, made of planed, well-seasoned lumber. For old tom-turkeys the size is 36 x 22 x 18 inches, and for young toms 36 x 22 x 15 inches; these should be of inch lumber. For chickens, ducks and geese the size is 30 x 20 x about 10 inches, or deep enough to allow for two layers, made of ⅝-inch lumber. Two layers of poultry should be packed in each case. Stow the poultry snugly and closely, striving to have as regular and handsome appearance as possible. Turkeys should be packed backs up and legs out straight. Chickens, ducks and geese should have the breasts down on the bottom layer and up on the top layer. Pack old toms separately, and never mix them with young toms and hens, and never pack old fowls and young chickens together. Each should be packed separately, and the kind neatly stenciled on the outside of the case.

When stock is frozen in natural out-door temperature the cases may be filled at once when the thermometer is below zero, but if above zero only one layer should be frozen at a time. Use no packing material whatever and be sure to protect from wind while freezing. When solid frozen the stock should be put away and kept where it will not thaw out, preferably in cold storage. When the poultry is to be frozen artificially the cases may be filled full and placed at once in the freezer. In this case it is well to construct the cases so that a slat in the sides of the box may be removed and left off until the stock is solid frozen; the quicker the freezing the better. In the freezer the cases should be separated by slats to permit free circulation of air around them. Some packers get excellent results by freezing the poultry separately and packing after frozen. Some of the very finest frozen poultry is handled in this way at near-by points, and is not packed at all until ready for market, when it is packed in straw and shipped for immediate sale before warm weather. But for large lots, sent from a distance, which have to be placed in storage again upon arrival in market, it is best to pack in cases before freezing.

HOLIDAY MARKETS.

The most important holiday markets for poultry are Thanksgiving Day, Christmas and New Year's. The supply for these occasions is usually very large and the demand chiefly for the very finest grades. Stock intended for holiday trade should therefore be prepared with extraordinary care that it may present as handsome and attractive an appearance as possible. Large turkeys should be forwarded up to Christmas; after that smaller sizes are preferred and bring most money. Chickens sell better for New Year's market than for either Thanksgiving or Christmas. Geese sell best at Christmas.

LIVE POULTRY.

Coops should be high enough to permit the poultry to stand easily upright without bending their legs and with space enough between slats to pass their heads through. The coops should be strong but light; heavy wood can be dispensed with if long nails are used. They should not be so large as to be awkward and cumbrous to handle. Where large coops are used they should have partitions, so that when the coop is accidentally tilted the whole weight of poultry will not be thrown upon those at the side and end. The poultry should have plenty of room. Crowding too many into a coop causes loss by suffocation. Only one kind should be sent in a coop when the size of the lot permits dividing the kinds. All poultry reaching here the following day after shipment should be fed lightly before being placed in the coop, so as to avoid any infringement of the law regarding food in the crops of poultry. Western and Southern poultry shipped to New York is generally in car-load lots accompanied by a man to feed and water them. The principal market days are Monday to Thursday inclusive. There is seldom much trade on Friday or Saturday.

EGGS.

There is scarcely any other article which requires so much care in handling in order to produce the best results, or in which such care is more certain to be appreciated by buyers. Those shippers who are successful in sending stock of

uniformly choice quality soon acquire a reputation for their brands that insures prompt sale and comparatively full prices at all times.

The wide fluctuation in the quantity of eggs produced according to the season of year, and the consequent tendency to wide range of prices from the period of greatest plenty in the spring and early summer to the period of light production in the fall and winter has led to a large business in holding eggs from one season to the other. This business would be assuredly profitable to a certain extent if the quality of the goods could be certainly preserved, and if the quantity held were not excessive. But the egg is so delicate that even with the most improved methods of refrigeration the flavor becomes old with long holding; and, moreover, the rapid extension of cold storage facilities of late years, and the efforts of cold storage warehousemen to attract goods to their stores have often resulted in so excessive a holding as to produce unprofitable and often disastrous results. The risks incurred in storing for long holding are therefore very great, and with the possible exception of holding in pickle, losses are as frequent as profits. It is probable that shippers who do not speculate at all, but who make it a point to ship fresh collections the whole year through, will make a better showing in the long run, and they certainly do a safer business.

Shipments of fresh collections should be made frequently, even if comparatively small lots are sent each time—especially in hot weather. Stock should be candled before packing, and all bad, heated, dirty and cracked eggs thrown out; the perfect stock only should be packed for first quality; but the dirty and cracked eggs, if sound and good, may be packed and shipped separately. They should, however, be closely graded, and free from all rotten eggs. There is usually a demand for candled and graded cull eggs at satisfactory prices, and marks which are known to be properly assorted and packed always get the best of the trade.

Eggs may be packed either in barrels or cases, but the use of the former has been abandoned by most shippers, and cases are now preferred by all classes of trade. Returnable cases are entirely out of date; all cases must go with the eggs, and the regular No. 2 egg case is sufficient for all purposes. During the season when demand is large for cold storing it is a great advantage to have lines of goods in packages especially suitable for this purpose; such are white wood cases with No. 1 kiln-dried fillers. Perfect fillers are very important for cold storing eggs, and they must be kiln dried. Deodorized fillers are now being produced which are free from all taste and flavors likely to be imparted to the eggs. These should prove far superior to the straw-board fillers for long holding.

Many shipments of eggs in cases arrive in market in poor condition owing to improper packing, while a little care and attention to details would insure perfect carriage of the goods. Shipments have frequently been received which lose heavily in cracked and broken eggs simply because the fillers were not made to fill the cases, and the space between the fillers and the cover permitted the contents to shake about, breaking many of the eggs and causing a generally mussy condition. Such goods, even though they may be of good quality otherwise, have to be sold at a serious disadvantage. The transportation companies do not handle their freight as carefully as they might, and fragile goods must be packed with a view to ordinarily rough handling in transit. To insure perfect condition under ordinary circumstances it is only necessary to pack the cases so that the contents cannot shift, no matter what position the packages are placed in. About one inch of fine cut, dry straw should first be placed in the bottom of the case and covered with a stiff paper or card-board; then put in the fillers and eggs. It is best to arrange the depth of packing at the bottom, so that when the case is filled there shall be a slight space between the top filler and the cover; then put a stiff paper or card-board over the top filler, and over this as much fine cut, dry straw or excelsior as can be put in without requiring too much pressure to fasten the cover on. This insures a solid package, the straw acting as a cushion, against which there is little danger of breakage. Never use damp, musty or worn fillers.

ATLANTIC FARM.

ATLANTIC FARM.

Atlantic Farm is one of the pioneer duck ranches of the country, having been established by Mr. Hallock's father on its present site forty years ago. Mr. Hallock raises, on an average, 15,000 ducks a year, and has one of the best-equipped plants on the island. A large number of breeders are kept to supply his many customers with eggs, and it goes without saying, that, with Mr. Hallock's early and long training, the type of ducks raised on the Atlantic Farm is the true one for the Pekin. Years of skillful and judicious breeding have made them ideal and perfect specimens, and all one might reasonably wish for in breeders. His birds are characteristic in their small head, compact shape and deep, long keel. These birds have won for Mr. Hallock many prizes when exhibited at the New York, Hagerstown, Washington and Boston shows.

He devotes all his time to the business, and employs three or four assistants. The work has to be done at the appointed time, and everything kept clean and tidy. His is one of the most orderly farms on the island.

Mr. Hallock begins at the beginning to encourage the growth of the ducklings. His method of feeding, which was used last year with perfect success, is as follows:

For the first seven days, equal parts, by measure, corn meal, wheat bran, and No. 2 grade flour, and 10 per cent. of this bulk coarse sand, mixed with water to a dry, crumbly state, and feeds four times a day.

From seven to fifty-six days old, equal parts, by measure, corn meal, wheat bran, and No. 2 grade flour, 10 per cent. of this bulk beef scraps, 10 per cent. coarse sand, and 12½ per cent. green food (green rye, oats, clover, etc.), mixed with water to a dry, crumbly state, and fed four times a day.

From fifty-six to seventy days old, 10 parts, by measure, corn meal, 1 part wheat bran, 1 part No. 2 flour, 12½ per cent. of this bulk beef scraps, 10 per cent. coarse sand, 12½ per cent. green food, mixed as before, but only fed three

times a day—morning, noon and night. The last feed is given an hour before sundown.

Ducks that are intended for breeders are not fed on fattening ration, so as not to weaken them by too much forcing. Those that are picked out at seven weeks for breeders, are given a mash composed of equal parts corn meal, wheat bran, green food, 5 per cent. beef scraps and 5 per cent. coarse sand and grit. A few picked ducklings on this system of feeding have made the rapid growth of 3 ounces at a week, 5½ ounces at two weeks, 7½ ounces at three weeks, 1 pound 3 ounces at four weeks, 2 pounds 6 ounces at five weeks, 3 pounds 12 ounces at six weeks, 4 pounds 12 ounces at night weeks, 7 pounds 4 ounces at nine weeks, 8 pounds at ten weeks and 9 pounds 3 ounces at eleven weeks. This is exceptionally rapid growth, and illustrates how rapidly a Pekin will take on flesh when properly handled.

The Atlantic Farm is situated some two miles from Speonk, and comprises about forty acres. The farm has several brooder houses, growing houses, killing house, and, in fact, everything that goes to make up a well-equipped duck ranch. The incubator cellar contains thirty 360-egg Cyphers Incubators. All the buildings on the farm are built after the most approved plans; inexpensive, but substantial in character.

Mr. Hallock puts up a 500 foot laying house this year, in a manner to divide up his breeders in pens of seven ducks and a drake. This is undoubtedly one of the best improvements he has ever made.

ATLANTIC FARM.

The double brooder house plan is used, with an aisle in the centre and rows of brooders on either side. These houses are 24 feet wide and from 100 to 200 feet long. The sides are about 6 feet to the eaves, and the roof 15 feet to the ridge, double pitched. The nursery brooder has a floor on a level with the plates, the upper story being used for a feather drying room. The nursery is plastered, and has a coil of pipe under the win-

dows in addition to the piped hovers, in order to keep the pens warm for early work. This house has no outside runs, while those for the growing stock have runs from 50 to 100 feet in length.

At one side of the brooder house is a small colony of individual houses, put up in an inexpensive manner with inch boards, the joints lapped with strips, used for growing ducks after they are taken from the cold brooder house to be fattened ready for market. When the ducks

Ducks do not like confinement; they must have exercise, the more of it the better. They need even more than chickens do, as their natures are restless, and they must be allowed as much freedom as possible. Another thing that is of much consequence—they cannot be kept as closely as chickens; ample ventilation must be provided to keep them in a healthy state. They should never be shut up tight in moderate weather; in fact, there are very few nights in winter when the breeding house doors should be

ATLANTIC FARM.

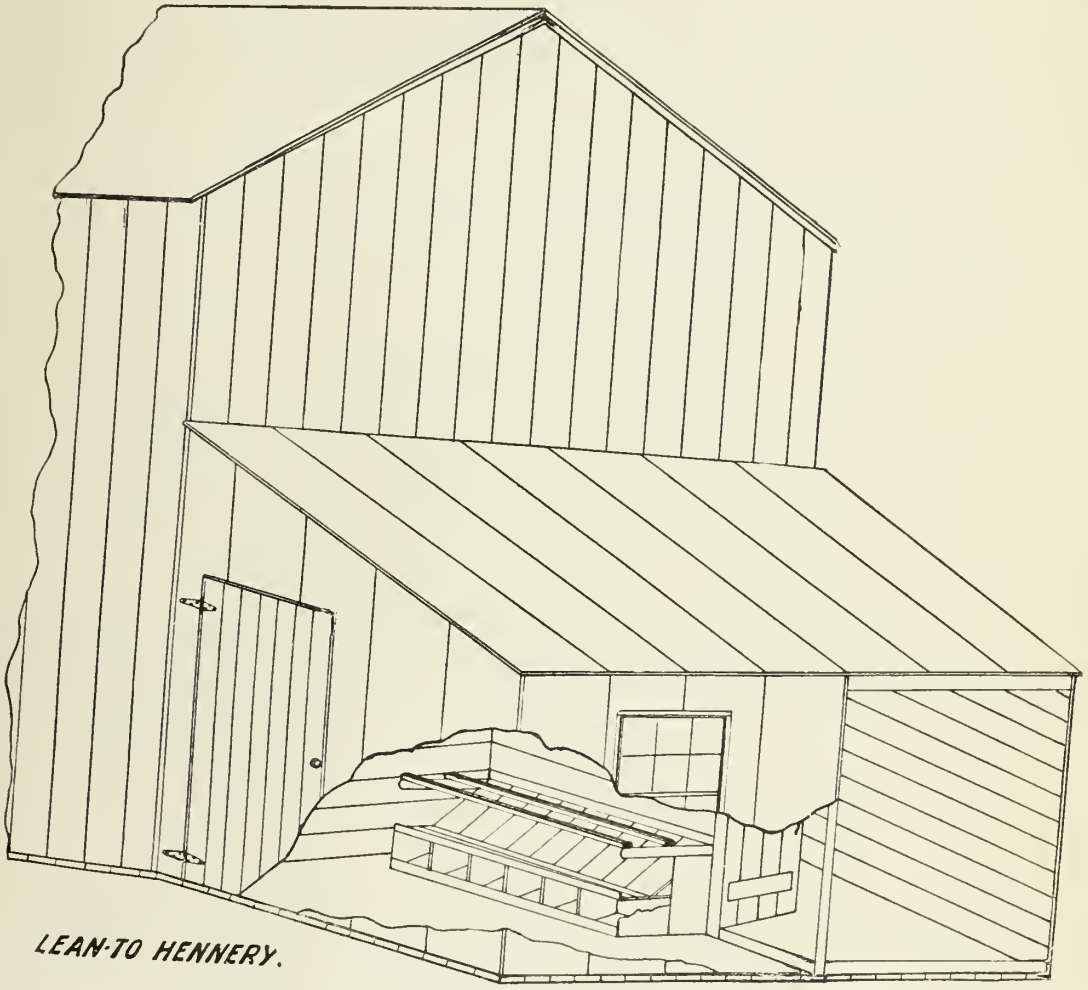
are taken from the cold brooder house they are carefully sorted over and the most promising ones are selected to be kept for breeders, and these latter are transferred to a separate colony of houses and allowed water for bathing, and enjoy it.

The breeders are all given runs with water fronts, and are allowed their freedom during the entire year. The laying houses are closed at night during the winter, and in the daytime when the weather is very cold and stormy.

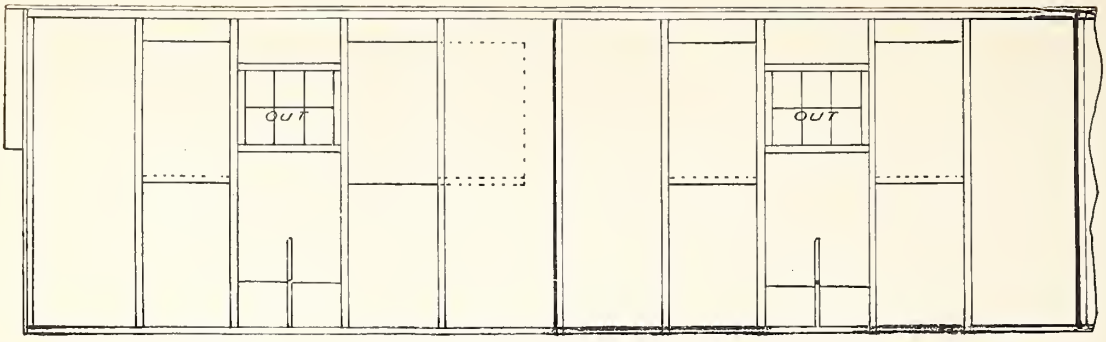
closed tightly. In spring, after the weather begins to moderate, the ducks seldom take to shelter at all; they spend their nights on the outside, and they are all the better for it. Mr. Hallock closes the houses bitter cold nights, but the birds are given liberty during the day excepting in cold, stormy weather. Ducks that are given their freedom are healthier and lay more eggs than do those that are closely confined. Mr. Hallock keeps his breeding ducks for two seasons, and some birds three, but seldom after

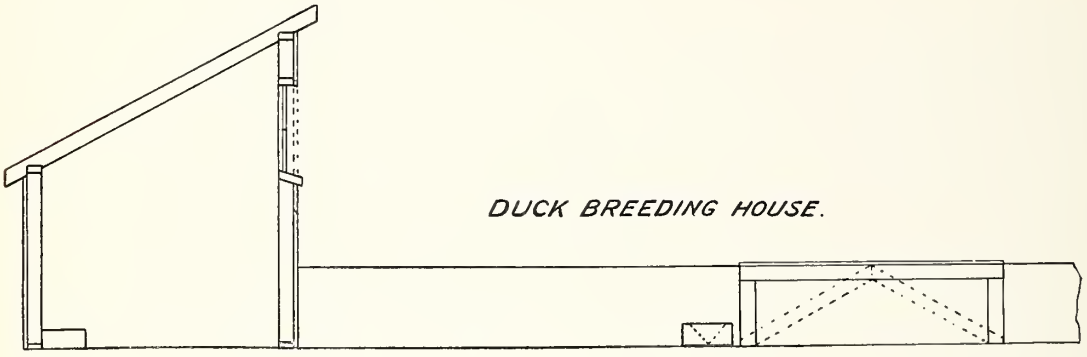
this time, as they prove unprofitable in egg production, and usually begin laying later in the season each succeeding year.

Early laying is the important part of duck raising, as it is the early birds that count, and bring in the largest income on the plant.

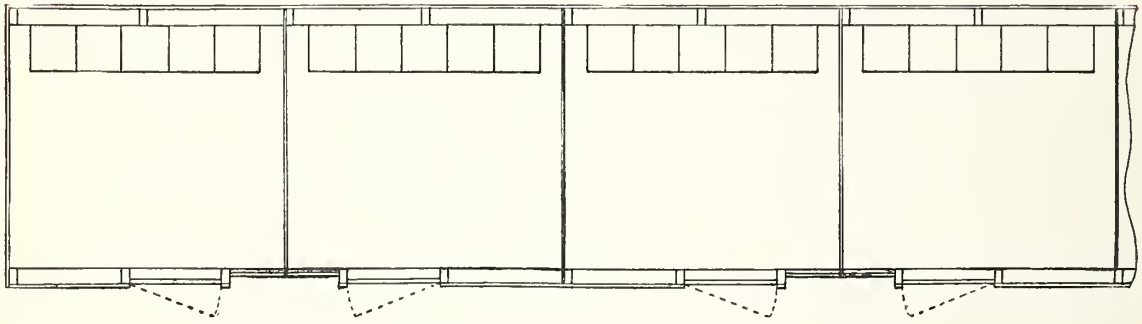


LEAN-TO HENNERY.





DUCK BREEDING HOUSE.



DUCK BREEDING HOUSE.

The plan given above of a duck house is one we use, and is far ahead of any we have ever seen. The back studding is 4 feet; the front, which should face the south, 6 feet; rafters 8 feet, all 2 x 4 inch, with 2 x 4 inch sills and plates. It can be either shingled and clapboarded or tar-papered. There should be a solid partition every 12 feet and a board division 2 feet high in the middle, making the pens 6 feet square. There is one six-light sash in the middle of the front, with a door either side leading into each pen. One of the lights of the window should be left out for ventilation, as otherwise the pen will sweat up at night when the doors are closed. The doors should be sawed in two across the middle, so that the top half can be opened the first thing in the morning, before the ducks are let out; or during stormy weather, when the slides under the windows can

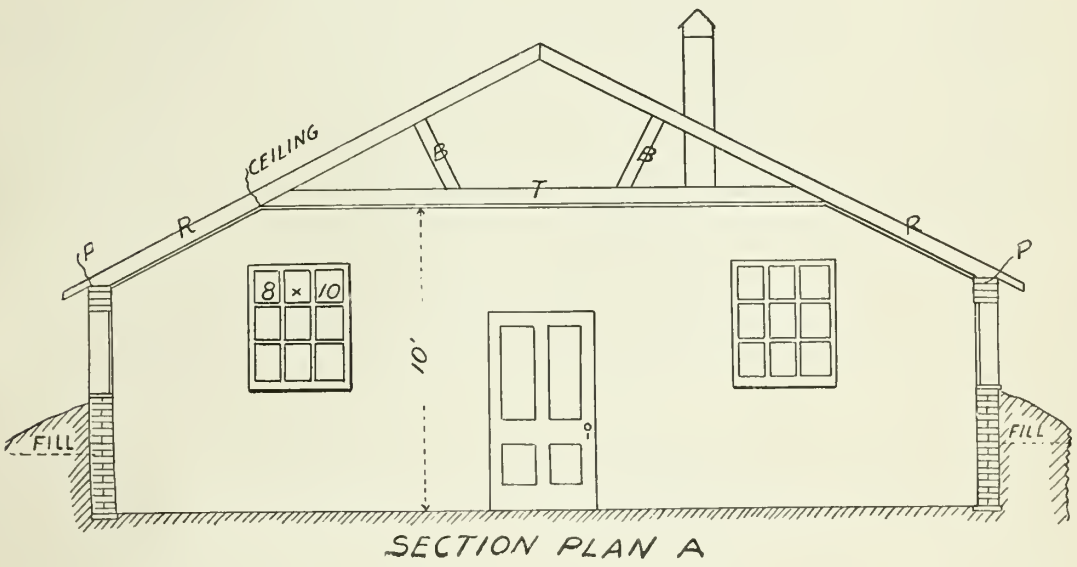
be used, leaving the bottom half of the door shut. In severe weather the ducks will be found to file out and in all day long. On sunny days, when both top and bottom are left open, the sun strikes the whole floor of each pen a portion of the day, and keeps the bedding dry, a very important feature.

The runs can be made of 2-foot wire mesh, and it will be found convenient in feeding, and for shade in summer to have a 4-foot walk about 12 feet from the front, extending the entire length of the building.

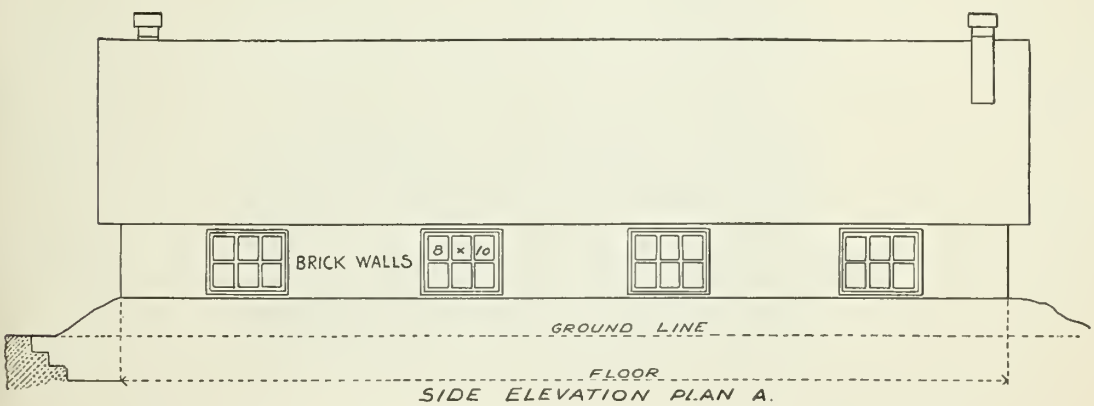
Ducks should always be watered and fed out of doors. Cold does not hurt them, only makes them eat a little more, while confinement in a warm building gives weak-germed eggs.

In moderate weather the top half of the door should be left open at night. Put seven ducks and one drake in each pen 6 x 6, and make the yards about 75 feet long. We shall never put in more ducks in one pen again than one drake can serve. When there is more than one drake in a pen, they interfere with each other, at times treading the same duck, etc., and the best results cannot be obtained. This plan will be adopted by Hallock, and several other large breeders the coming season, and will be in universal use within five years.

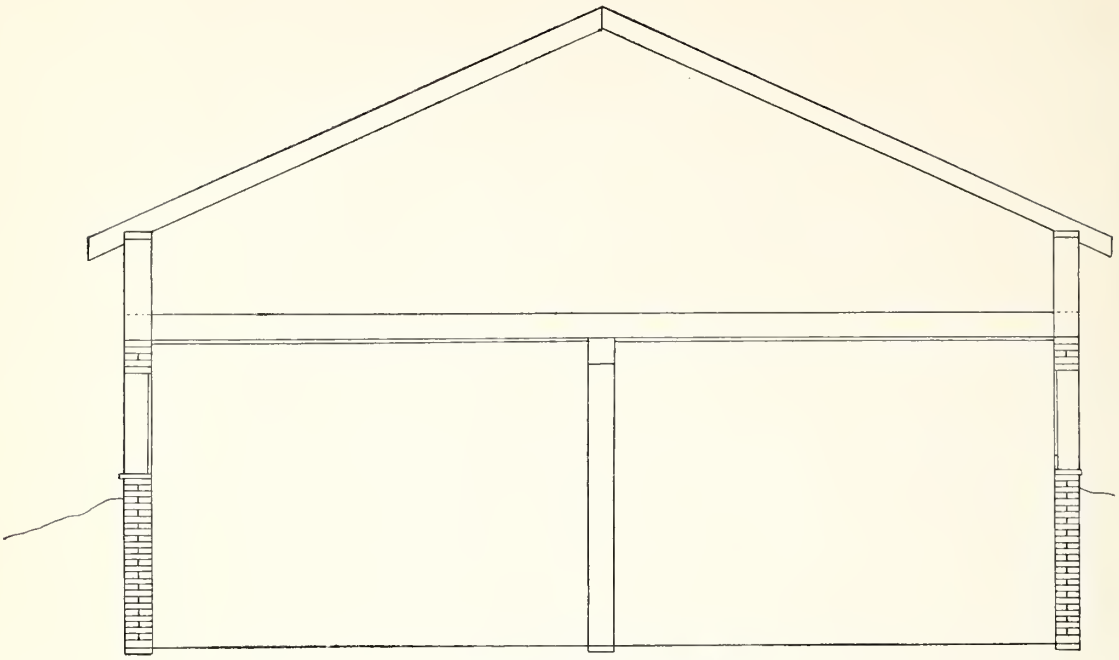
INCUBATOR CELLARS.



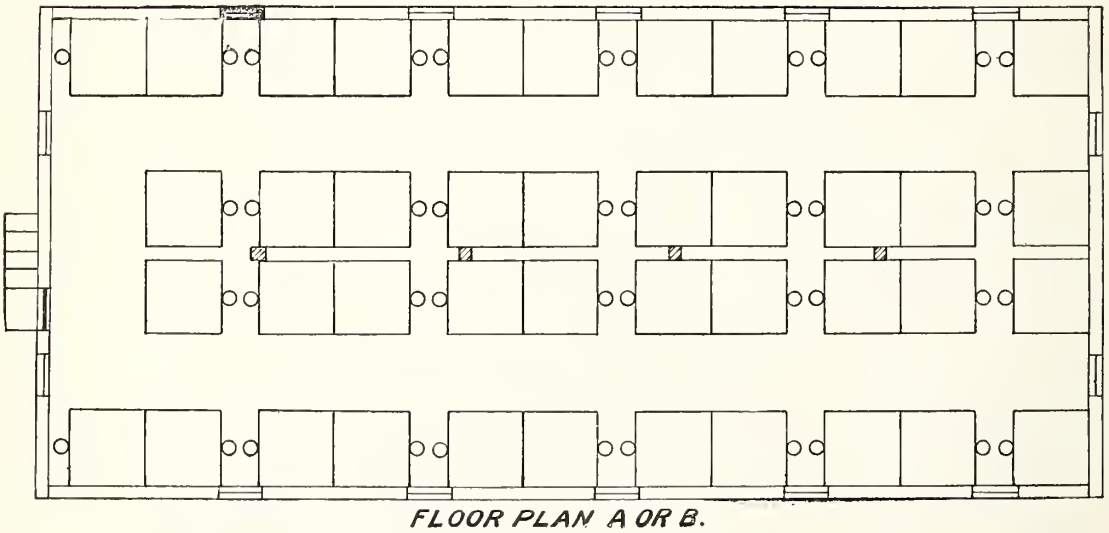
SECTION PLAN A



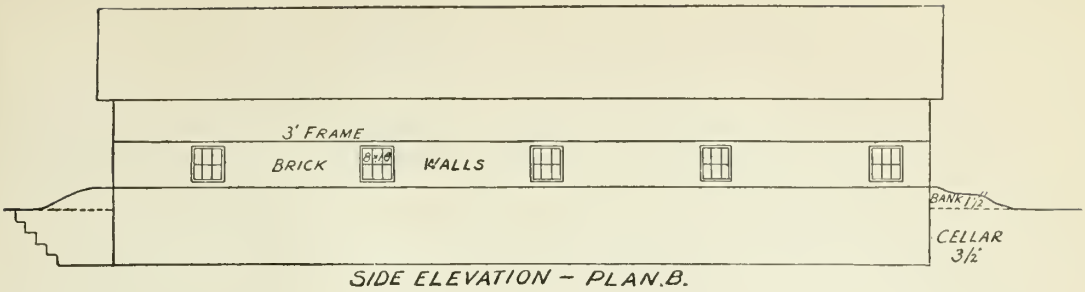
SIDE ELEVATION PLAN A.



SECTION PLAN B.



FLOOR PLAN A OR B.



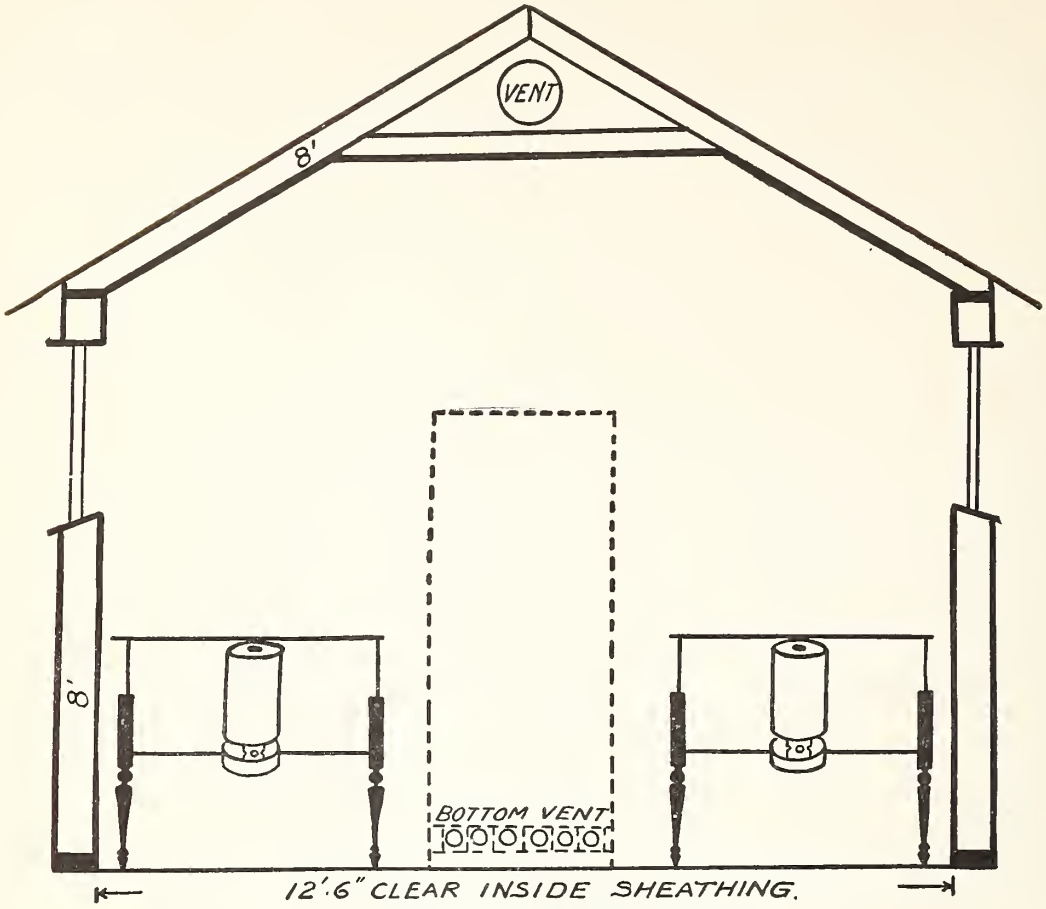
SIDE ELEVATION – PLAN B.

Plans "A" and "B" are half cellars, and, if put up early in the season, in dry ground, are very desirable. If the ground is soggy and wet, they should be built above ground, with brick walls. Plan "B" has a second story for a feather drying room. Plan "A" has an 8-foot brick wall; plan "B" 8-foot brick and 3-foot frame, the floor beams of the second story resting on top of the brick wall. Both roofs have a pitch of 1 foot in 2, and may be shingled or covered with 3-ply tarred felt. They should be either sheathed or plastered overhead. We like a window at least every 10 feet. Use 2 x 6 inch (16-foot) rafters, set 2 feet apart, and if the second story is added, 2 x 8 inch floor beams (two lengths 14 feet each), 8 inch square girders and posts. Rooms should be 24 feet 8 inches wide inside to hold four rows of machines, 25 feet long for eighteen machines and 5 feet additional for each four machines. Stairs to the feather room can go up outside, over those to the basement.

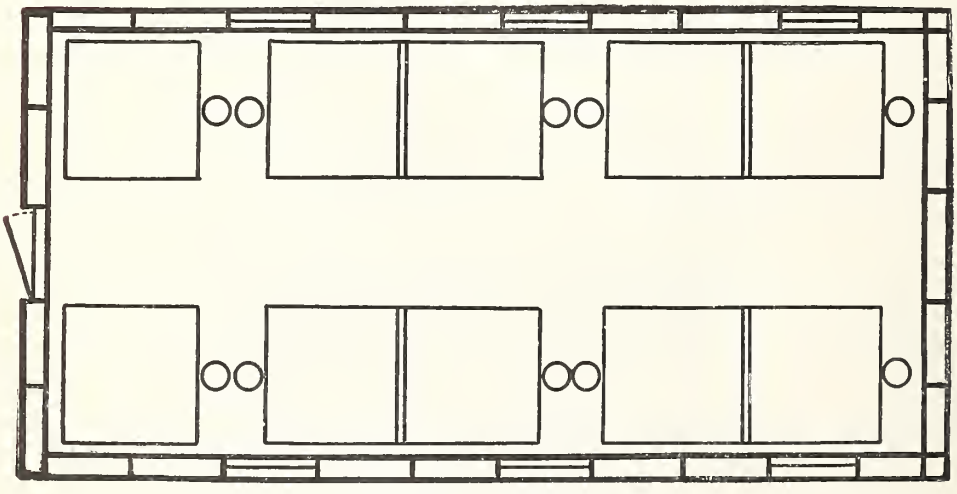
If it is desired to build entirely above ground, the brick wall will be found of advantage in keeping the room cool in late spring or summer.

Plan "C" is for four machines up, and can be made either a frame or brick building above ground, or a brick sub-cellar. It is 8 feet high to the eaves, 12 feet 6 inches clear inside in width, 10 feet long for the first four machines, and 5 feet for each additional two. Plainfield Poultry Farm Company has an incubator cellar 100 feet long, built on this plan, to hold forty Cyphers Incubators. H. G. Huey has one on this plan 50 feet long, built as the second story to a warm nursery, as he was short on land. He uses twenty Cyphers Incubators.

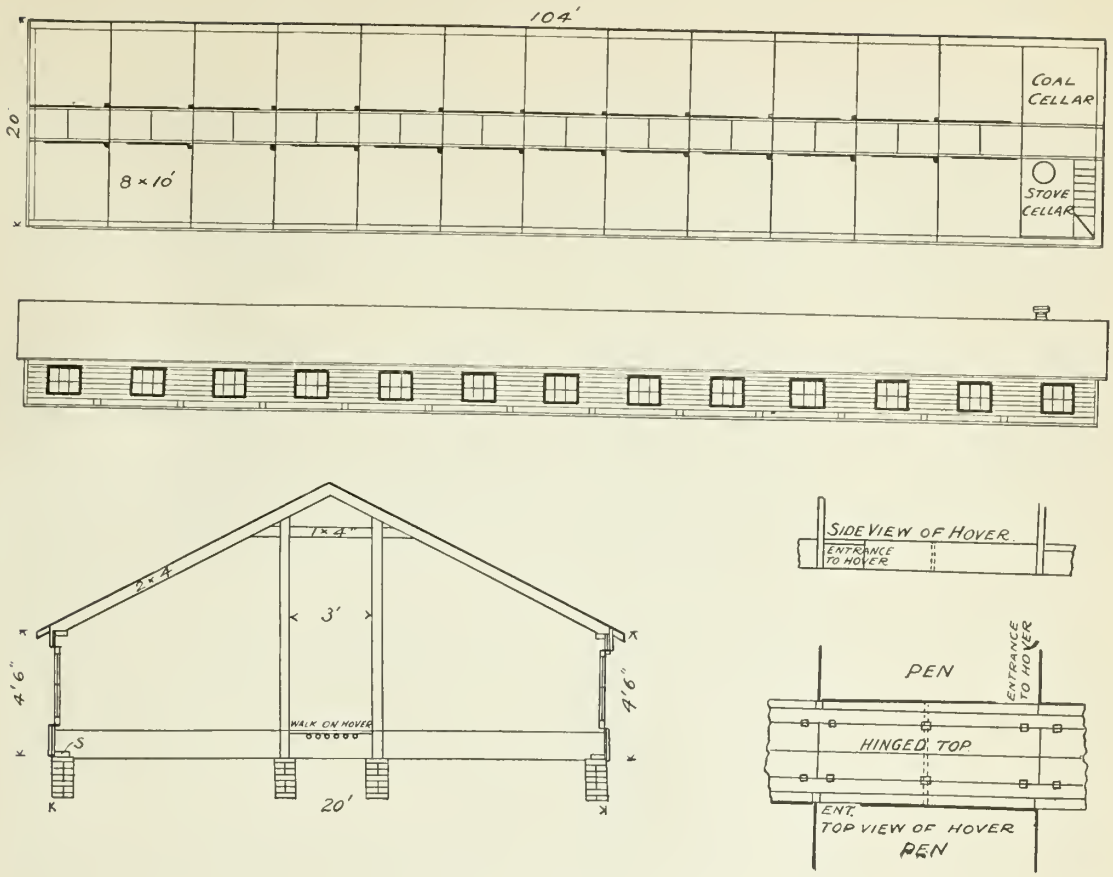
OUR OUT-DOOR BROODERS.



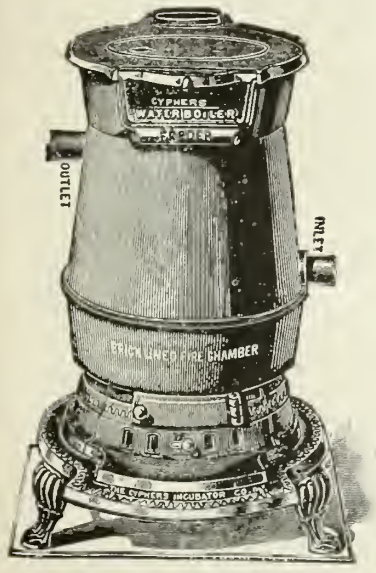
SECTION PLAN C.



FLOOR PLAN C.



LONG ISLAND DOUBLE BROODER HOUSE.

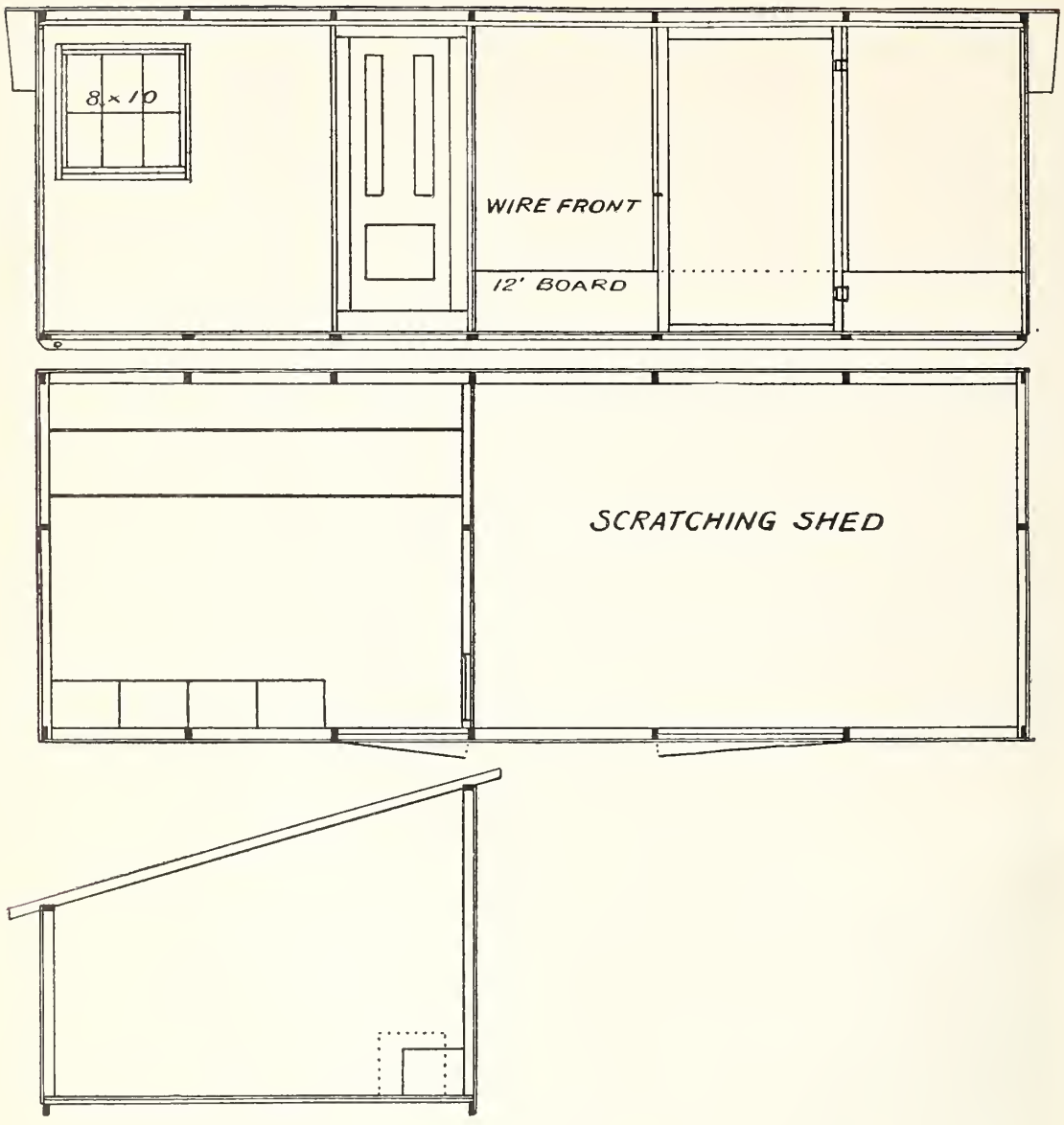


CYPHERS BROODER HEATERS.

Especially designed for heating brooders.
They keep fire well, as the combustion chamber is deep.
They are easily set up.
They are simple in construction and operation.
They can be connected quickly.
They give universal satisfaction.

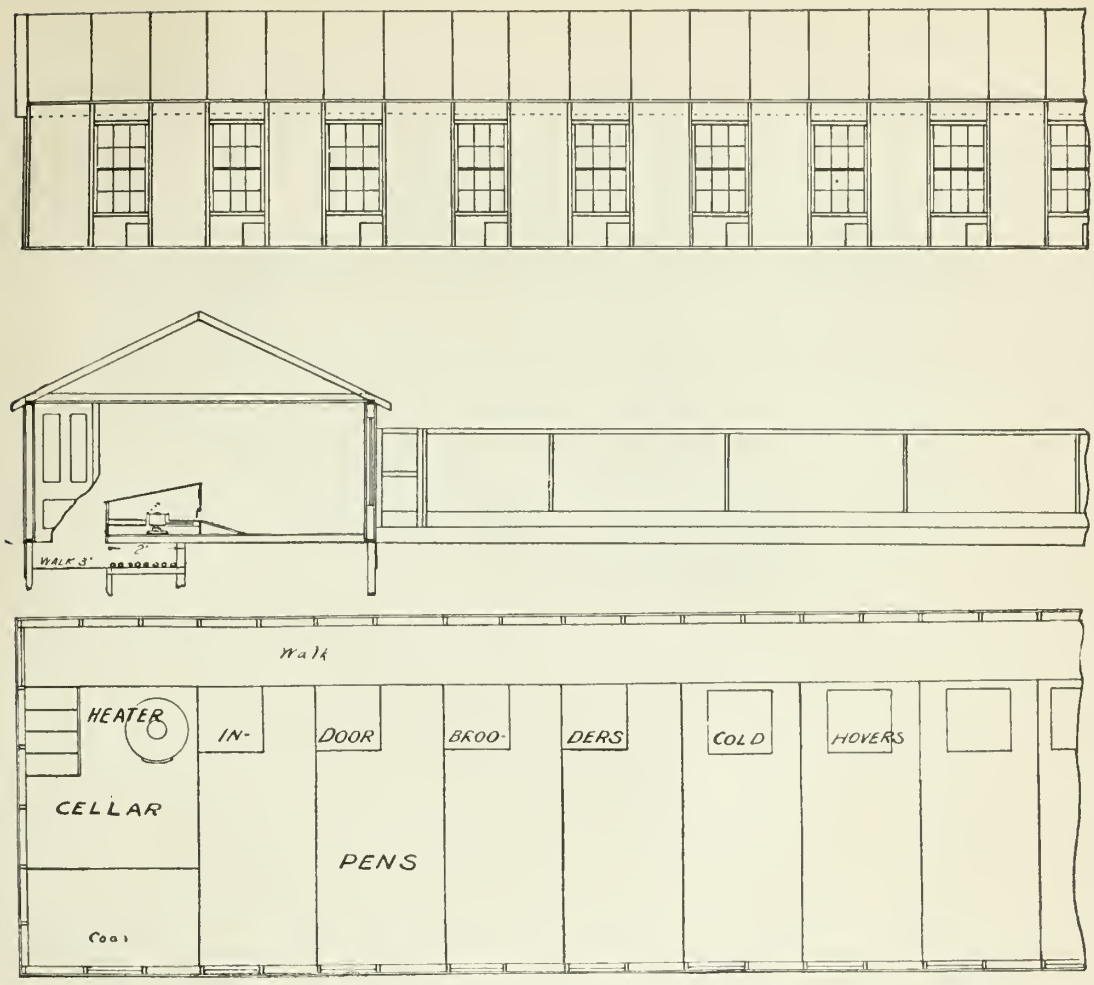
No. 1,	50 foot brooder	$18 00
No. 2,	75 " "	25 00
No. 3,	125 " "	38 00

Prices net, F.O.B. Syracuse, N. Y.



INDIVIDUAL LAYING HOUSES.

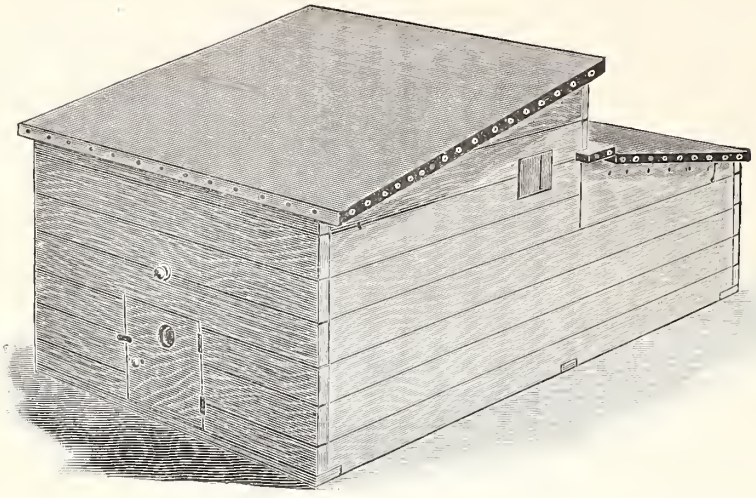
We are using the above style house with a great deal of satisfaction. They are 20 feet long, 8-foot roosting division, and 12-foot scratching shed ; 5 feet in front, 3 in the rear and 6 feet deep. In each house we place from fifteen to twenty-five hens. The roosting division is rough-boarded, papered and weather-boarded, and the scratching shed simply weather-boarded. There is a matched partition between the two divisions, and the roof is 3-ply tar felt. The floor joists are 2 x 4, laid flat-side down, spiked to two 20-foot 2 x 6's, and boarded over. We hitch a team to this house and draw it where we will, when we wish to change the yarding.



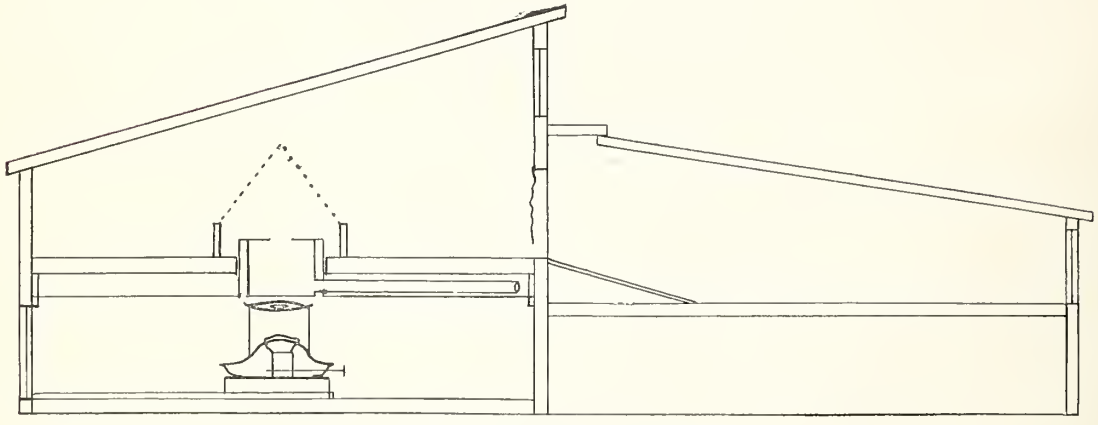
WARM NURSERY BROODER.

We have erected a 300-foot brooder, on the above plan, which we are using for a warm nursery. It is, without exception, the finest in the country, built on an ideal practical plan. The foundation is chestnut posts; 4 x 6 sills, 2 x 4 plates, studding and rafters, and 2 x 6 collar beams for ceiling. The studding are 7 feet to plates, and the building 16 feet deep, 3-foot walk along the back, and 13-foot pens. It is sheathed with tongue and groove stuff on the inside and overhead; rough-boarded, papered and weather-boarded on the outside. Three-ply tar paper roof; 12-light windows every 5 feet. Pens divided into 5 foot runs, the first 100 feet containing twenty. Style C indoor brooders. The artist here drew in style B, which is not correct, and time did not permit our having it changed.

The heating pipes are placed beneath a 30-inch matched floor, 1 foot below it, with the side next the walk left open. This system of heating pipes, consisting of four 1¼-inch flow, and four returns, is under the control of an electric regulator, which keeps the general temperature of the building at 70°. After the first twenty days the chicks are removed from the warm lamp brooders and placed in cold hovers of about the same size. The general temperature of the building (70°) being sufficient. From now on they are moved down from pen to pen, and at ten weeks are ready to go into cold buildings if the weather is not too severe. There is a 2-foot ventilator through the top every 50 feet, with a slide damper on the bottom where it faces the ceiling. This building meets all the demands of a perfect brooding house, with ample ventilation, and temperature perfectly regulated.



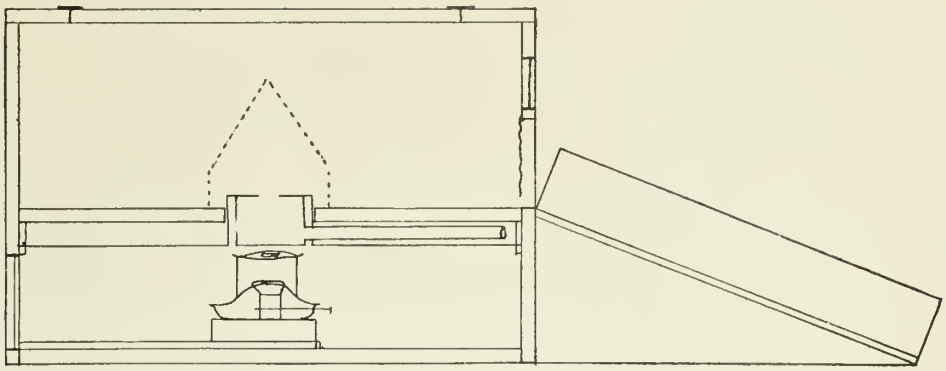
CYPHERS OUT-DOOR BROODER. FLOOR SURFACE 3X5 FEET. HEIGHT, 28 INCHES.



CROSS SECTION CYPHERS OUT-DOOR BROODER.

This style is designed for a cold weather brooder, and has a large heating capacity. It has a ⅞ pine roof, covered with tin, and all nicely painted. It supplies more top than bottom heat, though the floor is comfortably warm—not hot. No hover is used. The forward division is a valuable improvement on out-door brooders, as it furnishes a moderately warm run for feeding and exercise during stormy weather.

Price, $10 net. F. O. B. Wayland, N. Y.

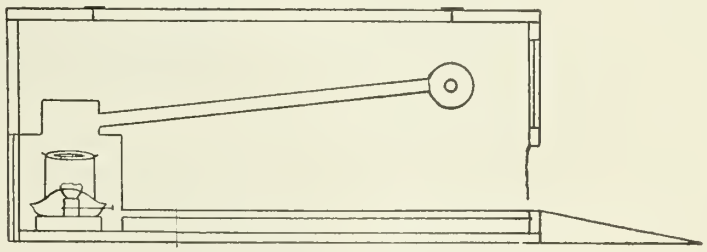


CYPHERS IN-DOOR BROODER, STYLE B.

Style B is designed for cold buildings that have no other heat than supplied by the hover. The step is hinged, and a leg attached to the outward edge holds it up level with the floor, forming a confined run for the first day.

Floor surface, 3 x 3 feet : height, 22 inches.

Price, $8 net. F. O. B. Wayland, N. Y.



CYPHERS IN-DOOR BROODER, STYLE C.

Style adopted in our 300-foot warm nursery :

Top heat is used, yet it has an advantage of a moderate bottom heat, a portion of the warm air being drawn into a space between the double floor, heating the latter sufficiently to keep the bedding dry and comfortable.

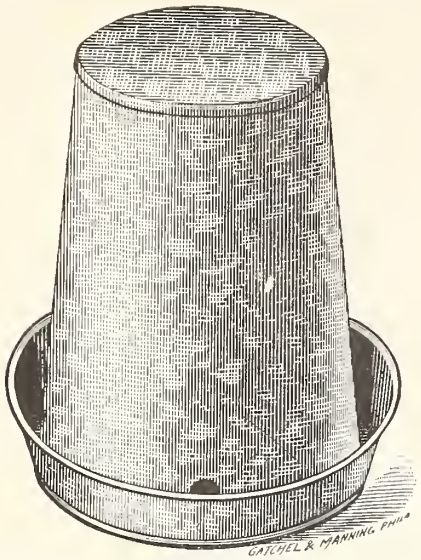
This is the only brooder supplying bottom heat where the lamp is above the floor.

There are no stairs to climb and no pits to be dug for the brooder to rest in. Any part of it can be opened, and a glass door keeps the chicks in plain sight all the time.

There is no danger of fire, as the lamp chamber is all metal. We prefer this style where the general temperature of the room does not fall below 40°.

Floor space, 3 x 3 feet ; height, 18 inches.

Price, $7 net. F. O. B. Wayland, N. Y.



CYPHERS DRINKING FOUNTAINS.

We claim that these galvanized-iron drinking fountains are an improvement on the other styles of fountains now on the market. A fountain that can not be easily and readily cleaned out, and in which water soon becomes sour, is highly objectionable. A fountain that will burst if the water in it freezes up is also an annoyance. The fountain shown herewith is easily filled, easily cleaned and kept clean, and will not burst open should the water freeze in it. The interior of these fountains can, after being scalded, be exposed to the sun and thus sweetened and kept wholesome. If placed in the shade in summertime the water will keep very nearly as cool as in an earthen vessel. They are much lighter than the earthenware fountains, and a dozen can be put in a compact and cheap package for shipment. The weight of the stone or earthenware fountains makes it impracticable to ship them by express, as the express charges come to more than the cost of the fountains.

Two Quart	each,	$0.25,	per dozen, $2.50
Gallon	each,	.35,	per dozen, 3.25
Two Gallon . . .	each,	.50,	per dozen, 4.75

INCUBATOR THERMOMETERS.

High-grade tested incubator thermometer: Two by mail, $1.10; six by mail, $3.00; twelve by express, $5.00.

BROODER THERMOMETERS.

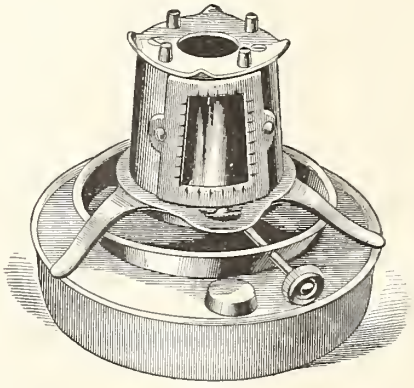
Two by mail, $0.80; six by mail, $2.00; twelve by express, $3.50.

METALLIC PARTS FOR BROODERS.

Can be purchased separately where the customer wishes to do his own wood-work. One brooder will need to be ordered for pattern, however, as we do not furnish plans.

Price for complete outfit, consisting of brass stove, galvanized iron parts for either style brooder, vents and thermometer, $4.50.

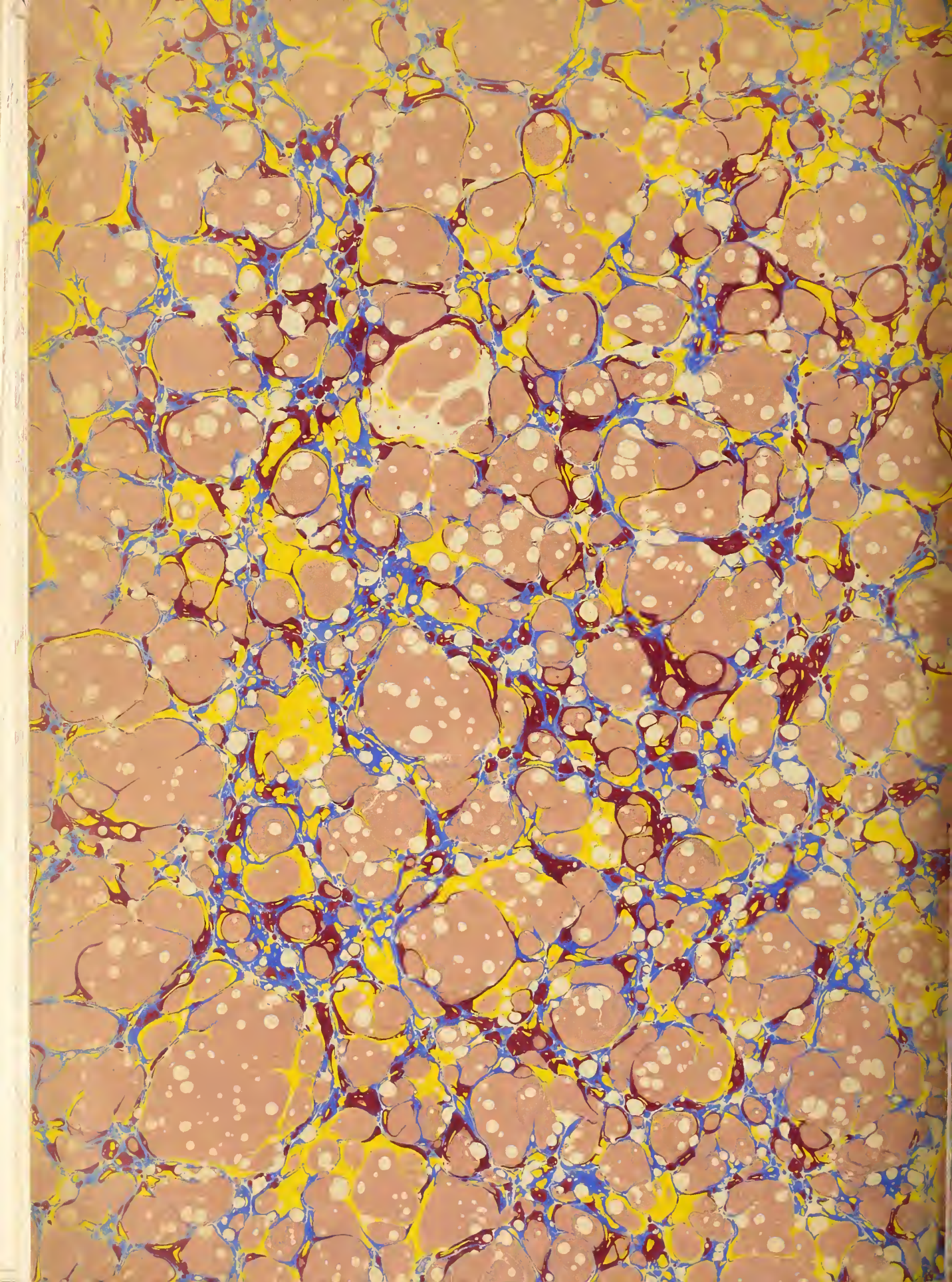
5 per cent. discount on lots of three; 10 per cent. on lots of six, and 15 per cent. on lots of twelve.



CYPHERS BROODER STOVES.

Powerful heaters, durable and safe. Water-jacketed wick tube. Oil fount, wick tube and water jacket made of brass.

Price, $1.50 each; $15 per dozen.



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